ENVIRON

May 4, 2009

Matthew J. Ohl
Remedial Project Manager
Superfund Division
United States Environmental Protection Agency –Region 5
77 West Jackson Boulevard
Chicago, IL 60606

Re: Augmented SVE Trench Completion Report for Attachment Z-1 Remedy
Consent Decree, Civil Action No. IP 83-1419-C-M/S
Envirochem Site, Zionsville, Indiana

Dear Mr. Ohl:

The attached report entitles *Augmented SVE Trench Completion Report for Attachment Z-1 Remedy*, dated April 30, 2009, is the revised version of the report (originally submitted December 15, 2008) that was prepared in response to comments provided in your letter of March 30, 2009. Revisions to the text in response to your comments are highlighted in yellow. For ease in your review of this document, the following lists your comments, by number, and designates where you can find the revised text responsive to your comment:

- Comment 1: See Section 1.7.2, page 17.
- Comment 2: See Section 1.2.5.4.3, page 6.
- Comment 3: See Section 1.2.5.6, page 8.
- Comment 4: See Section 1.2.5.7, page 8.
- Comment 5: See Section 1.2.5.8, page 9.
- Comment 6: Section numbering after Section 1.2 corrected as noted.
- Comment 7: See Section 1.3.9, page 11.
- Comment 8: See revised Figure C-9.
- Comment 9: See revised Figure C-11.
- Comment 10: In response to comment No. 10, please note that the 1987 ROD was for a combined remedy for ECC and Northside Landfill, which was subsequently changed to an SVE remedy for ECC alone in the ROD Amendment of 1991. A separate remedy was selected for Northside Landfill. The ECC remedy was subsequently modified to the 1997 Revised Exhibit A remedy which included excavation of the southern concrete pad area and dual level SVE in the central and northern portions of the site. In 2001, it was concluded that the Revised Exhibit A remedy as constructed would not achieve compliance.

  Accordingly, we believe that the operative original estimate for this site is the estimate for the Z-1 Remedy that is now being implemented. That estimate was developed by Environ in 2006. Construction costs were at the time estimated as being in the range of $2 million and O/M was estimated at $500,000.

  Actual construction costs, as contracted for, include a contractor determined schedule of values item of $435,000 for initial O/M to achieve compliance with SVE the shut-down criteria. Excluding that amount, construction costs have been approximately $2,640,000. Additional design costs incurred since the estimate was prepared were approximately $145,000. After SVE compliance is achieved, we are estimating additional O/M expenses at approximately $300,000 (i.e., total O/M related estimate is $735,000).

Please note that these values may change based on the ongoing investigation, repair and upgrade as needed of the treatment plant and the trench system to address the SVE and excess trench water issues encountered since startup. Additionally, the future O/M estimate includes a number of assumptions that also may need to be revised at a later time.

Please contact me if you have any questions regarding the enclosed.

Sincerely,

John P. Imse, R.G.
Principal

Cc: Thomas Krueger – USEPA
Bruce Hamilton – IDEM
Timothy Harrison – CH2M Hill
Norman w. Bernstein – Trustee
W.C. Blanton – Trustee
Ron Hutchens - ENVIRON

**AUGMENTED SVE TRENCH
COMPLETION REPORT
FOR
ATTACHMENT Z-1 REMEDY**

**ENVIRO-CHEM SUPERFUND SITE
ATTACHMENT Z-1 REMEDY
985 SOUTH U.S. HIGHWAY 421
ZIONSVILLE, INDIANA**

Prepared for:

Environmental Conservation and Chemical
Corporation Site Trust Fund

Submitted by:

HIS Constructors, LLC.
5150 E 65th Street, Suite B
Indianapolis, IN 46220

April 30, 2009

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SECTION 1.0 AUGMENTED SVE TRENCH CONSTRUCTION PLAN

HIS Constructors, LLC. (HIS) is pleased to present this Augmented SVE Trench Completion Report to the Environmental Conservation and Chemical Corporation (Enviro-Chem) Site Trust Fund (TRUST). The required services will be for the successful completion of the Attachment Z-1 Remedy at the Enviro-Chem Superfund Site located at 985 South US Highway 421in Zionsville, Indiana.

1.1 Purpose

The TRUST had a need for the construction of an augmented soil vapor extraction (SVE) system to be installed by trench method. The trench installation included excavation utilizing a biopolymer-based slurry, backfill with free-draining gravel, installation of high-density polyethylene (HDPE) SVE screen, and permeable reactive gate system (PRGS) piping. The trench also included dewatering wells, and surface backfill.

The Augmented SVE Trench Construction has been completed in accordance with the contract between HIS and the TRUST, dated November 14, 2007 (the "Contract") and the Design Report as referenced in the Contract, except that, as noted below, construction of several trench segments was completed using the trench box method. The Design Report utilized historical information and physical information including soil borings, temporary monitoring well installations, surface water evaluations, and laboratory analysis of various soil, vapor and water samples.

Attachment Z-1 Remedy activities are intended to addressed the concerns of the United States Environmental Protection Agency (USEPA) and Indiana Department of Environmental Management (IDEM).

1.2 Mobilization/Site Preparation and Support Activities

1.2.1 Submittals

Prior to mobilization, HIS prepared the required submittals for the TRUST review and approval. The submittals included Insurance Certificates, a Standby Letter of Credit, and Plans such as the Site Specific Health and Safety Plan (HASP), Augmented SVE Trench Construction Plan, as well as the Project Schedule and those submittals listed on the Table found in Section 01010-6.
HIS also contacted subcontractors or vendors and arranged for delivery of equipment and executed the appropriate subcontractor agreements and shop drawing submittals. Prior to any construction activities commencing, HIS identified utilities located on the site by contacting the Indiana One-Call local utility location system.

1.2.2 Safety Meeting

During the work onsite, the Project Specific Health and Safety Plan was reviewed by HIS and our subcontractors, and a pre-activity site safety meeting was held. Each person gaining access to the site was required to verify that they had reviewed and understood the plan with a signature. Emergency procedures were discussed and outlined at that time.

1.2.3 Health and Safety / Air Monitoring

HIS's Health and Safety Officer (SSO) conducted daily monitoring of noise, dust, proper PPE use and documented daily weather conditions. HIS's SSO performed ambient excavation air monitoring required by HIS's Health & Safety Plan. Contamination and reduction zones were established, monitored and maintained by the safety officer.

Daily tailgate meetings were held to ensure the Health and Safety Plan was followed, and to review the previous day's events and the upcoming day's schedule.

Real-time air monitoring was conducted to identify additional emission control measures, work practice revisions, or contingency measures need to be implemented. Action levels, as established by the Health and Safety Plan, were not met during the work at the Site.

Real-time air monitoring was performed at locations downwind of the active work area and within the work area. A field technician using hand-held monitoring instruments performed periodic monitoring as remediation activities proceed throughout the workday. The total volatile organic concentrations were measured using a MiniREA PID. The real-time sampling equipment were zeroed prior to each run and operated and maintained in proper working condition according to the manufacturer's specifications.

On April 15, 2008 Attachment Number 1, Confined Space Entry, to the Health and Safety plan was approved. The Attachment covered the change in trenching methodology from biopolymer slurry to conventional methods using trench boxes. This method required personnel to enter the open trench to make connections of the SVE and PRGS piping. Continuous air monitoring was required along with entrant to be on supplied air.

1.2.4 Mobilization

HIS mobilized personnel and HIS owned equipment from its office based out of Indianapolis, Indiana. Additional construction equipment was delivered from local rental companies. The mobilization phase was dovetailed into the site preparation phase of the project. Administrative support, exclusion zones, decontamination areas, and staging were identified and established.

1.2.5 Site Preparation

After the equipment and personnel were mobilized to the site, site preparation began. The preparation consisted of the following sub-tasks:

- **Designation of Equipment and Vehicle Staging Area / Temporary Utilities**
- **Site Zone Delineation**
- **Site Control Measures**
- **Site Security**
- **Site Survey**
- **Personnel and Equipment Decontamination Areas**

1.2.5.1Traffic Control

HIS used the known points of entry and exit for site personnel and delivery vehicles. Both access gate were kept closed to avoid confusion with any work being done at adjacent facility. HIS inspected the site gates on a daily basis to ensure proper security and working condition.

1.2.5.2 Designation of Equipment and Vehicle Staging Area / Temporary Utilities

HIS utilized the pre-construction meeting with the TRUST to designate construction equipment staging areas, mix plant location and personal vehicle parking. Only authorized personnel were allowed to park personnel vehicles in the designated areas. HIS installed #53 commercial stone within the parking areas, temporary access roads and the laydown area shown on Drawing C-2. At the completion of the construction activities it was decided to leave the laydown area in place.

HIS installed a 10’x50’ trailer for office resources. HIS located the trailer along the support zone fence to utilize the existing power source at the site. An approved electrician connected electrical service within the trailer area.

Temporary utilities were also established within the contractors designated staging area. HIS’s on-site Superintendent had a cellular phone for contact and emergency purposes. HIS obtained non-potable water from an adjacent pond located to southwest of the Site. HIS provided a drinking water cooler, a rubbish container and portable toilets within the trailer support area.

1.2.5.3 Site Zone Delineation

Prior to excavation activities beginning, the site was delineated into the proper safety and work zones. Orange construction fencing and barrier tape were established as a divider for each delineated area.

Within the actual boundaries of the work site, varying levels of protection were required in different areas of the site. These levels of protection were determined by the type of activity being performed at a specific location and the potential for exposure at that location. Zones were identified as the site was set up and these zones were adjusted as conditions changed. These zones consisted of:

1.2.5.3.1 Support Zone

This area consisted of the offices, equipment and material staging areas, and break areas. HIS and TRUST personnel utilized the office trailer staged onsite. Potentially contaminated equipment or materials from the exclusion zone were not allowed into this area without first going through the Contamination Reduction Zone (CRZ)/Decontamination Area.

1.2.5.3.2 Contamination Reduction Zone (CRZ) And Decontamination Area

These two zones were adjacent to each other and are usually not delineated separately. The CRZ is the zone in which reduction of gross contamination of the equipment took place. This included the removal of mud and any material possible prior to entering the actual decontamination area.
The Decontamination Zone was the area in which the actual decontamination of equipment and personnel took place.

The decontamination (decon) pad had already been constructed on site to contain the various fluids, which was generated in the interim and final removal of the potentially contaminated material. Upon completion of the decontamination activities, equipment and trucks were free to exit the decon area and proceed to the support zone.

1.2.5.3.3 Exclusion Zone

The exclusion zone was that area where contaminated/hazardous material may be located and the potential for worker exposure exists. The exclusion zones for the site were marked with the use of barrier tape or construction fencing. All equipment and personnel exiting the exclusion zone were required to pass through a single point at the CRZ to the decon area prior to entering the support zone.

1.2.5.4 Site Control Measures

Site control measures detail the methods utilized to control emissions of dust, organic vapors, as well as manage noise, storm water, and other potential contaminant/nuisance emissions associated with the proposed excavation and piping installation. The following will provide details relating to the implemented site controls.

1.2.5.4.1 Dust Control

HIS made arrangements with the Recycling Center to obtain water from their on-site pond. Dust was controlled through the use of clean water and material management practices. Dust generated from site activities was minimal during this project.

Vapor suppression was available during activities at the site, however, it was not utilized at the site. HIS monitored both ambient air and air within the trench and there was no evidence of organic volatilization as measured by air monitoring procedures described in the HASP.

1.2.5.4.2 Noise Control

Noise control for this project was achieved by establishing hours for equipment operation at the site. HIS planned on working ten (10) hours per day, five (5) days per week. There were two instances that required Saturday work.

Each piece of equipment was maintained throughout the project to ensure that the noise reduction plan was being followed. Safe speed limits were established to minimize the noise and dust. In addition, delivery hours were established and shipments were made during normal business hours.

1.2.5.4.3 Erosion Control

Prior to intrusive work beginning at the site, erosion control measures were implemented. Erosion control was achieved by establishing silt fence along the eastern edge of the proposed trench alignment, to prevent water run-off from entering the Unnamed Ditch. HIS also repaired or installed silt fence along the Southern Support Diversion Channel as shown on Figure C-2.

During the installation of Segment 3, some biopolymer slurry seeped through the trench in the general direction of Unnamed Ditch. Silt fence in this area was fortified with straw bales and additional fencing. No Slurry went past the silt fence or reached Unnamed Ditch.

1.2.5.4.4 Control of Excavation, Storm and Decontamination Waters

Trench excavation and decontamination waters were collected and stored in an approved storage container (Frac Tank).

All water transfer lines and storage vessels were water tight and inspected on a daily basis.

All stored liquids, during construction, were transferred to Tank T-2 treated via the onsite treatment system and discharge into Unnamed Ditch.

1.2.5.5 Clearing and Fence Installation

No trees or brush were removed during trench excavation activities. Installation of the new fence was completed at the completion of the construction phase and prior to the beginning of the Active Phase of the project. No trees or brush interfered with fence installation activities.

1.2.5.6 Site Survey

Location control during this project was accomplished in three steps as follows:

1. For control survey services, HIS employed, USI Consultants, Inc. (USI), a subcontract surveyor that had previous experience and knowledge of the site and its many features.

   Tasks for the surveyor were establishment of starting and ending points, corner locations, and line and grade stations. Elevations established were those of the trench work platform.

2. For operating layout work that occurs almost daily, HIS performed survey work using tape measurements from the previously-surveyed monuments installed by the USI survey crew including:

   - Offsets of corner monuments,
   - Intermediate stations, with offsets
   - Levels for control of working platform for measuring elevation of the bottom of the trench.
   - Level and width of the cap over the trench.

3. For measuring trench depths, HIS utilized a laser level and grade rod. These depths were measured several times each day. The depth of the trench was measured from the previously-surveyed work platform as follows:

    - Depth to the bottom of the trench after excavation.
    - Depths of the advancing backfill slopes and/or to the bottom of the trench immediately prior to backfilling.
    - Pipe elevations.

Measurements were not changed when trenching activities changed from using Slurry to conventional methods of trenching using trench boxes.

1.2.5.7 Personnel and Equipment Decontamination & Spill Contingency Areas

Personnel Protective Equipment (PPE) for this project was expected to be Level D. Site personnel were not expected to come in direct contact with impacted soil. Personnel decontamination used dry decontamination methods at the equipment decontamination pad. PPE utilized, (i.e., disposable boot, tyvek, and etc.), were removed and placed in drums. Hand wash facilities were provided through the use of a pressurized sprayer and plastic rinse container. Eye wash facilities were also available at this location.

PPE for work during conventional trenching activities utilized supplied air with full face respirators for employees that would be entering the excavation. A ten minute rescue air pack was supplied to each entrant and attendant (See Confined Space Entry Plan, Attachment 1 of the Health and Safety Plan).

A personnel and equipment decontamination pad had already been constructed. The decontamination pad was used to decontaminate equipment prior to leaving the Contamination Reduction Zone (CRZ).

Decontamination water was transferred to Tank T-2 during construction for future treatment and discharge.

Sorbent pads and booms were maintained and stored at the site for possible spill clean up, and a spill contingency was constructed for this phase of work between the treatment building and the decontamination pad.

1.2.5.8 Soil Stockpile and Loadout Area

A soil stockpile and loadout area was required. Material was placed at the trench excavation area into a stockpile for each trench segment. Analytical results of the stockpile determined the disposition of the soil material. The installation of a clean backfill stockpile was required to facilitate the trench cap installation services at the site.

An impermeable liner was installed adjacent to the trench segment, prior to soil being stockpiled onto the impermeable liner. Hay bales and liner were used around the perimeter of stockpiled materials.

1.3 Trench Construction

This section describes the construction of the augmented SVE trenches utilizing the biopolymer slurry excavation method and the changes to conventional trench excavation methods. The section includes descriptions of equipment, excavation methods, mixing methods, slurry usage, piping installation, and stone backfill placement. This section provides a description of material, quality control (QC) equipment, tests, sampling, and QC forms as per Specification Section 02210 of the Design Report. Since all trench segments will be handled virtually in the same manner, we have not addressed the physical remediation of each separate segment area as shown on the Figures presented in the Project Drawings.

1.3.1 Responsible Organizations and Contacts

HIS was the general contractor for this project. The HIS project manager was Kieran Hosey. Geo-Solutions, Inc. (GSI) was under subcontract to HIS to share in the contract activities described in this submittal. GSI is a firm specializing in providing on-site technical services and specialty equipment for slurry trench construction. HIS provided engineering, labor, standard construction equipment, and overall supervision for the trench construction. GSI reported to the HIS Project Manager.

GSI served as the slurry trench subcontractor. The staff of GSI have designed, constructed and supervised over 500 slurry walls of all types for a combined total of more than 100 years. Specially, the staff of GSI has supervised the construction of more than 60 biopolymer trench installations. GSI provided supervision, quality control and specialty equipment for the construction.

Mr. Keith Kilpatrick of GSI served as the on-site slurry trench specialist. Mr. Kilpatrick has been engaged in the construction of slurry walls for more than 20 years. His experience includes successful management and supervision of slurry trench construction including the methods for: controlling, mixing, placing, cleaning and maintaining slurry; supervising alignment, verticality, and depth of slurry trenching; controlling blending, mixing, and placement of slurry wall backfill; and a thorough knowledge of slurry trench construction equipment and material testing.

1.3.2 Trenching Scope of Work

The scope of trench activities included the planning, construction, and testing of 7 trench segments as part of an augmented SVE system. The segments totaled 978 linear feet, 2 feet wide, and up to 14 feet deep. Trench Segments 1 through 5 were, at least partially constructed by the biopolymer (BP) slurry trench method and backfilled with a gravel and pipe. Segments 4, 6 and 7 were constructed with conventional methods utilizing a trench box. The Design Report for the Z-1 Remedy required the installation of the SVE and PRGS piping using BP slurry. Due to both partial and complete trench collapse at several of the trench segments, it was determined to proceed using conventional methods of trenching.

1.3.3 General Sequence of Trench Operations

Slurry trench construction relied upon an excavator digging the trench, a slurry mixing plant located at the staging area, and an earthen working platform alongside the trench for staging and installation of the materials that are subsequently placed in the trench. The slurry trench construction generally consisted of three major operations, all executed simultaneously and coordinated with each other. The first is slurry mixing. Slurry mixing in this case was accomplished with a slurry mixer furnished by GSI. The mixer consisted of a colloidal mixer, re-circulation pump and storage tanks. Slurry was prepared from biopolymer and water and then pumped to the trench heading through lay-flat hose, as required.

Conventional trench construction also relied on an excavator digging the trench within a trench box. The trench box used for trench construction was 3 feet inside and 16 feet long.

The second operation was excavation. This was accomplished with a hydraulic excavator capable of reaching the design depths. Backfill operations were completed as close as possible to the excavation at all times.

The third operation is the backfilling operation. The backfilling operation consisted of pipe and gravel backfill placement. As the trench was excavated, the soil was staged on visqueen adjacent to the trench segment, away from the work.

1.3.4 Materials

The basic materials for construction included: water for slurry, biopolymer (a mixture of guar gum and preservatives), trench box, pipe, and backfill gravel. As described previously, water was being provided from an adjacent pond. Water was delivered to the batch plant area via hose.

Pipe was delivered in 40-foot lengths obtained from Forrer Supply. Backfill stone was provided by HIS from a local quarry operated by Martin Marietta and was trucked to the site in on-road dump trucks.

1.3.5 Work Platform

Based on the trench locations, the existing ground surface was used as the working platform. No buried or overhead utilities interfered with the trench construction. Abandoned pipes were plugged to avoid filling with slurry and backfill.

1.3.6 Trench Excavation Equipment

The slurry trench was excavated with a Caterpillar 330 excavator. The excavator was capable to excavate at least twenty- feet (20') deep. The excavator was equipped with a 2-foot wide bucket.

1.3.7 Bio-Polymer Slurry Mixing Equipment

The BP slurry was mixed in a 2.5 CY digester and a frac tank. Ingredients were added in both the mixer and the frac tank. The tank was continually agitated with a re-circulating pump during working hours. The mixing operation was supported by a forklift for handling ingredients and operated by one worker.

1.3.8 Gravel Backfill Placement Equipment

The backfill gravel was placed with a backhoe with acceptable bucket size and reach. A bucket size of 2-4 CY was used for backfill placement. The excavator was also used to place backfill from a stone box, when the backhoe could not gain access to the trench.

1.3.9 Trench Excavation Method

The trench was excavated under BP slurry with a hydraulic excavator. The standard procedure for excavation was as follows:

Began a new excavation on the centerline by digging a trench less than 2 feet deep and the length of the Segment. Slurry was introduced into the excavation as the Segment was completed to depth. Excavation continued by removing soil in layers from the bottom of the excavation. Removing loose soil on either side at the surface was not a good option due to restrictions along the trench Segments, the Thin Barrier Curtain Wall and RCRA liner. During installation using BP slurry excavated materials were placed adjacent to the trench, but not within 5 feet of the excavation. The excavation was completed using a two foot wide excavator bucket. Vertical limits of trench segments were maintained to within 2 tenths of a foot of designed completion elevations (See Attachment 1). Excavated material staged along trench segments was graded to match original conditions as part of the Site Restoration. This process was the same for all trench segments with the exception of Segment 4, Segment 6 and Segment 6 off shoot. Approximately 467 cubic yards of soil was excavated from Segment 4 and was placed on top of the RCRA cap. Approximately 195 cubic yards from Segment 7 was also staged on the RCRA cap. The material from Segments 4 and 7 was covered with clayey material from borrow area in Carmel Indiana. Material removed from Segment 6 and Segment 6 off shoot was taken to Heritage Environmental Services RCRA landfill in Roachdale Indiana. Approximately 1254.96 tons of material from the Site was taken via tri axel dump trucks to the Heritage facility.

On February 28, 2008 it was decided to change from BP Slurry to conventional trenching methods due to issues that arose with the BP Slurry method. The conventional method utilized a trench box. The trench box that was used was 16 feet long, 3 feet wide and 14 feet deep. The excavation was completed by digging inside the trench box and lowering it to completion depth. The trench box was then dragged along the trench until the excavation was completed.

1.3.9.1 Thin Barrier Curtain Wall Consideration

To avoid any damage to the Thin Barrier Curtain Wall the following steps were taken during installation of the SVE trench. A surveyed mark out of the Thin Barrier Curtain Wall was conducted prior to any trenching activities. Each trench began 4 feet from these marks, making the center line of each trench 5 feet from the Thin Barrier Curtain Wall. As an added precaution, HIS unearthed the geotextile that separated the Thin Barrier Curtain Wall from the native fill that was used to cap the top 2 feet. This was done by scraping the top 1 foot of material above the Thin Barrier Curtain Wall with an excavator and hand digging the additional foot until the geotextile had been identified. The excavator scraped a maximum of 6 inches in each pass. This process was completed at least once for every Segment.

1.3.10 Slurry Preparation and Maintenance

The BP slurry was mixed in a digester. Mixing was accomplished by adding dry powder from bags to high-velocity water in the mixer. With the slurries, the discharge from the mixer was directed to the storage tank for additional mixing and hydration. Circulation was maintained with a separate pump and a distribution system.

1.3.10.1 Bio-Polymer Slurry Use

Biopolymer slurry was used for supporting the trench walls and degraded after trenching. BP slurry was made by batch mixing. The BP slurry was sampled from the tank circulation system and tested as required. In general, viscosity and pH are the quickest and most usable indicators of workability and quality, so frequent tests of viscosity and pH were conducted. Marsh Funnel Tests were used to test viscosity. Tests of the BP slurry was conducted a minimum of twice daily. If the fresh slurry did not comply with the specification, more guar gum, additives or a longer mixing time were employed.

The procedure that was employed when mixing fresh slurry were as follows:

- Adjust flow of water through mixer for maximum mixing efficiency.
- Pour guar gum powder from bags into mixer.
- Adjust flow of guar gum for maximum mixing efficiency.
- Pump slurry to storage tank.
- Obtain sample of slurry from storage tank.
- Test slurry: Marsh Funnel and pH tests.
- Add preservatives and adjust slurry properties, as necessary.
- Retest slurry.

The in-trench slurry was sampled from the trench and tested at a minimum of twice daily. Sampling from the top and/or mid-depth or surface of the trench usually provided the most representative samples. A Marsh Funnel test and pH test were used as indicators of workability and stability. The in-trench slurry complied with the specifications and no adjustments were required, some fresh slurry was introduced into the trench to maintain an acceptable level within the trench.

1.3.10.2 Degradation of BP Slurry

At the completion of the trench installation, there was excess BP slurry in the trench and within the pore space of the gravel backfill material. In order to re-establish the permeability of the surrounding soils and to permit groundwater to flow into and through the trench, it was necessary to breakdown the BP slurry. The slurry breakdown process was completed by circulating the slurry/water in the trench. The excess slurry water, along with the excess slurry was held in frac tanks and treated with enzymes and aeration.

The breakdown of the BP slurry was accomplished by; 1) breaking down the polymer slurry to simple carbohydrates (sugars), 2) encouraging native soil microbes to consume the carbohydrates, and 3) polishing included adding enzymes and aeration.

> The pH of the slurry was adjusted to match the optimum range of the enzyme breaker. Controlled amounts of muriatic acid were added to the slurry for pH adjustment.
>
> After the pH of the slurry was satisfactory, the liquid enzyme breaker was added while continuing to circulate the slurry to the frac tanks. Enzyme breaker was added at a rate necessary to break the slurry based on the slurry specialist’s observations, but generally in the range of 1-gallon enzyme breaker per 4,000 to 20,000 gallons slurry.

The above measures were adequate to break the slurry. A Marsh Funnel Viscosity < 30 seconds indicated the slurry was broken. Also, the BOD were reduced to 1,000 mg per liter or less in each trench segment.

The pumping and re-circulation continued until a minimum of 2 pore volumes of the trench was circulated to flush and develop the trench.

1.3.11 Backfill Placement

Following excavation of approximately 50 percent of the trench, backfill stone was placed. This was accomplished by dropping the stone into the trench from the material handling equipment. Backfill placement continued until it was placed to within 6 inches of the invert elevation of the slotted SVE screen or the PRGS conveyance pipe. The pipe was then placed as described below in section 1.6.12. Once the pipe was installed, backfill stone placement then resumed until it was brought to within 2 feet of the work surface.

HIS installed 2,331.19 tons of free draining gavel within the trench segments. In addition to the free draining gravel HIS used 99.13 tons of pea gravel and 166.35 tons of sand to bed and backfill the manholes and PRGS Vessel. This material was provided by Martin Marietta Materials.

1.3.12 Slotted SVE Screen and PRGS Conveyance Pipe Installation

Following the placement of backfill gravel to the design invert elevation of the PRGS conveyance pipe or SVE screen, pipe installation began. The pipe installation was comprised of pipe preparation and installation.

1.3.12.1 Pipe Preparation

Pipe preparation was comprised of the following steps using BP Slurry:

- 40-foot sections of 4" diameter HDPE pipe was fusion welded together, including cleanouts and risers at the correct locations, to form a continuous run of pipe. Pipe was staged adjacent to the trench.
- Pre-fabricated concrete weights were then attached around the pipe using all thread. Weights were attached on approximately 15-foot spacing.
- Cables were then attached to the pipe weights. The cables were cut to the appropriate length to allow the pipe to descend to the invert elevation.

1.3.12.2 Pipe Installation

Pipe installation was as follows using BP Slurry:

- In trench segments that have both PRGS conveyance pipe and SVE pipe, backfill gravel was placed to the pipe invert elevation of the PRGS conveyance pipe. The PRGS conveyance pipe was the lower pipe and SVE was above it with spacers installed between to maintain required spacing. In segments that require only SVE pipe, the backfill was placed to the invert elevation of the SVE pipe.
- The pipe (or both pipes where required) was placed into the trench with an excavator and by hand.
- A 4"x4" lumber was slid through a loop at the top of the cables. The 4"x4" was placed to span across the trench. The pipe was then suspended by the cables.
- Each section of cable was measured above grade to ensure that proper elevation was met for each segment.
- The pipe was verified to be at the proper invert elevation by assuring that the cables were taught when the pipe was laid into the trench. The pipe was surveyed using a level from a benchmark onsite with a known elevation. The process of using a known elevation to confirm the invert elevation of the pipe(s) was carried out at a minimum of every 15 feet and where the PRGS conveyance and SVE pipes enter each manhole and as the PRGS conveyance pipe exits each manhole.
- Backfill material was carefully placed into the trench, bedding the pipe(s) in place.
- This process was repeated as trench construction progressed.

Pipe installation was as follows using Conventional Methods:

- In trench segments that have both PRGS conveyance pipe and SVE pipe, backfill gravel was placed to the pipe invert elevation of the PRGS conveyance pipe. The PRGS conveyance pipe was the lower pipe and SVE was above it with spacers installed between to maintain required spacing. In segments that required only SVE pipe, the backfill was placed to the invert elevation of the SVE pipe.
- The pipe (or both pipes where required) was placed into the trench by hand. Piping segment were cut from 40 feet long to 14 to 16 feet long to match the length of the trench box. Pipes were welded together inside the trench using electorfussion couplers.
- The pipe was surveyed using a level from a benchmark onsite with a known elevation. The process of using a known elevation to confirm the invert elevation of the pipe(s) and where the PRGS conveyance and SVE pipes enter each manhole and as the PRGS conveyance pipe exits each manhole.
- The non perforated SVE above ground piping was run to the treatment system building in accordance to the design report. This four inch HDPE piping was terminated outside of the treatment building. The flex hose was then connected to 4-inch ID PVC pipe with a hose clamp. The 4-inch ID PVC pipe was connected to 3-inch ID PVC pipe via a reducing fitting. The 3-inch ID PVC pipe

extended from outside the treatment building through the wall of the building and the connections were made to the existing three inch manifold of the SVE system.

1.3.13 Dewatering Well Installation

The dewatering wells, including the temporary wells installed for trench development, were installed directly into the trench prior to backfill stone placement. Each temporary well was removed after slurry breakdown. The permanent wells were checked for verticality prior to and during backfill stone placement.

1.4 Trench Cap

After the trench was backfilled to with two-feet (2') of the proposed surface, the trench was capped. Capping activities included placing the geotextile, geomembrane, and compacted trench cover, and removing excess backfill and soil materials.

Standing water within the trench was removed via pumping, as practical/possible, prior to the placement of clean backfill. In addition, a non-woven geotextile followed by a geomembrane was placed above the gravel, extending to the widest portion of the trench. The pieces of geotextile and geomembrane along the trench length were overlapped a minimum of three-feet. All geotextile seams were sewn together and all geomembrane seams were welded together.

HIS imported 85 tri axle dump truck loads of clayey backfill, each truck load carries approximately 20 tons of material, this material used for the trench cap conformed to the requirements set forth in the Contract Documents for clean backfill. Clayey backfill was imported from a borrow area in Carmel Indiana. The required acceptance testing and geotechnical testing was performed on the clean fill material. Backfill was delivered to the excavation via off-site delivery vehicles that followed a pre-determined on-site haul route adjacent to the immediate trench segment area being backfilled.

An excavator was used to place the material into the trench in loose 8-inch to 12-inch lifts. The excavations were backfilled from the "bottom up" in continuous horizontal lifts and placed as required to achieve the final design grade in a manner that promoted positive surface drainage away from the area. A sheepsfoot roller was used for compaction on the lifts. The clayey backfill was compacted to 95% Standard compaction as determined by soil proctor.

1.5 Site Restoration

Once trenching activities were complete and the site was finish graded to the proper elevation, HIS installed the final surface restoration. At two locations, at least 6 inches of #53 stone were placed and compacted at the surface for a roadway crossing. Graded areas were made to blend with remaining ground surfaces, seeded and mulched. Once restoration activities were completed, temporarily relocated structures were returned to their original condition. In addition HIS constructed an eight-foot (8') tall fence along the eastern edge of the property line.

1.6 Water Storage & Disposal

The wastewater storage area was located at the laydown area. All water that came in contact with exposed waste was conveyed to the primary containment storage tank for gravity settlement of solids. The primary component of the wastewater storage system included storage containers for wastewater storage and surge capacity. Approximately four cubic yards of solids that accumulated in the frac tanks were transferred to the soil stockpile area on top of the RCRA Cap and covered with clayey material.

Pumps were placed within the areas from which waters were generated. Accumulated waters were pumped from the areas through piping or hoses to water storage area. Liquids did not need filtration and treatment to remove the suspended particles prior to storage of the water. A visual inspection of the accumulated water, for suspended particles, took place before water was transferred to Tank T-2 to ensure the treatment plant was not damaged.

Prior to discharge to Unnamed Ditch, stored water was treated in the on-site treatment system and delivered into Tank T-4 for analytical testing per the requirements of the Design Report. Upon receipt of approval by IDEM of the quality of the treated water, the water was discharged into Unnamed Ditch. Through the life of the project approximately 800,000 gallons of water has been treated through the on Site water treatment system.

1.7 Trench Quality Control

1.7.1 Trench Performance Testing

Once the BP slurry breakdown process was completed the performance test was conducted. The performance test was conducted by pumping from the dewatering well at a rate of 5 gallons per minute until the trench was dewatered. During the testing approximately 65,000 gallons was treated through the on Site water treatment system. HIS successfully preformed the trench performance test as required at each trench, except as to Segment 3, which is discussed below. Additionally all piping that was installed during the construction phase of the project was successfully pressure tested, to ensure that the HDPE welds did not leak.

1.7.2 Trench Non-Conformance

During the installation of Segment 3, HIS encountered the Resource Conservation and Recovery Act (RCRA) cap at the southern end of Segment 3. The RCRA cap was cut and laid back to allow for the installation of the SVE and PRGS piping in Segment 3. The location of the RCRA cap was surveyed to ensure proper replacement. During the installation of the of the geomembrane liner covering each trench segment the anchor in Segment 3 was replaced and matched the existing RCRA cap anchor trench.

HIS discovered that the dewatering well at Segment 3 was installed a foot higher than designed and would not allow for complete dewatering of the trench. HIS installed a bottom intake pneumatic pump with an internal float in lieu of the pump and sensor in the Design. The float on this pump actuates at eleven and a half inches above the bottom of the sump. This level has allowed for the complete dewatering of Segment 3 (Specification included in Attachment 2).

Also, during the installation of Segment 7, a six inch corrugated drain pipe was discovered. This drain pipe was allowing water to drain freely into Segment 7. HIS plugged this drain pipe by pumping a bentonite grout into the pipe, successfully stopping the flow of water into Segment 7. In addition to this, the EPA requested that the pipe be traced to the edge of the property and again plugged at that location. This work was completed by HIS at the request of the TRUST on September 8, 2008. The location of the former corrugated drain pipe is shown on Drawing C-8.

1.8 Excavation Sloping Requirements

Workers were required to enter excavations when trenching was done with conventional methods. All work associated with intrusive activities was accomplished using the excavators. The primary concern with excavation sloping requirements was sidewall stability and maintaining a safe excavation for the ground personnel working adjacent to the excavation.

1.9 Excavation Safety Procedures and Equipment Requirements

Personal safety was the primary concern for any operation on-site. At a minimum, the following procedures and equipment was utilized:

- The site was divided into three zones. The exclusion zone, contamination reduction zone and the support zone. No one except OSHA, 40 hour trained personnel were permitted inside the exclusion zones. All personnel checked in with the excavation supervisor prior to entering or leaving the exclusion zone.

- All open excavations were marked with caution tape, construction fencing or rope.

- Excavation sidewalls were inspected daily by a certified Competent Person for structural stability. Due to cave-in and collapse of trench segments, conventional trenching was utilized.

- Employees that entered the excavation were in supplied air and met all requirements outlined in Attachment 1 to the Health and Safety Plan.

- Stockpiles constructed adjacent to the excavation were held a minimum of four (4) feet from the edge of the excavation.

- All loose materials and soils were removed from the heavy equipment before it moved to the next trench segment.

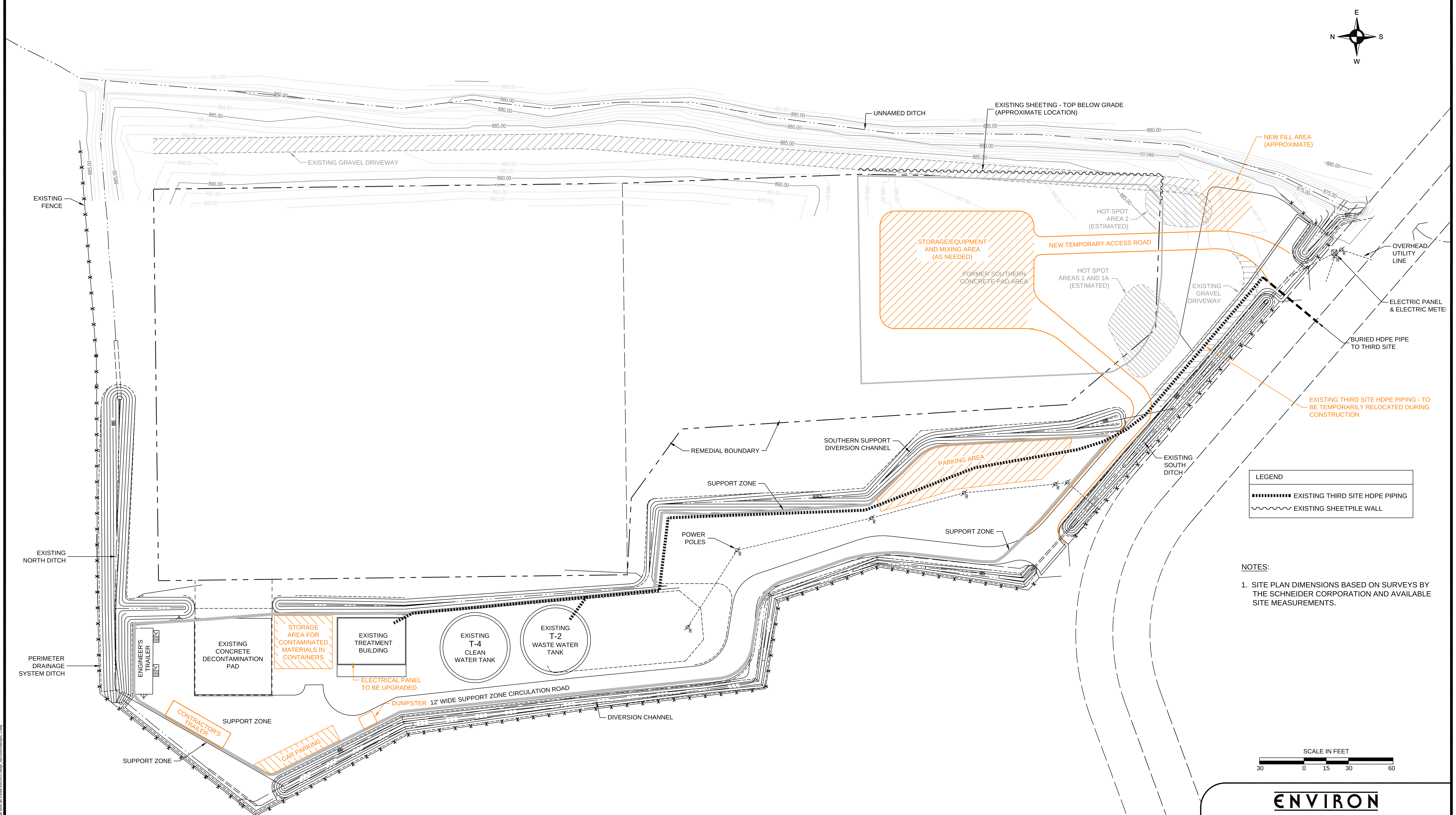
Construction Completion—Consistent with the Z-1 Remedy and the Design, construction of the SVE trenches was completed October 17, 2008.

2.0 Post Construction Activities

Several tasks have been completed since construction of the SVE trenches:

- SVE system shakedown and startup has been completed.
- Installation of pneumatic pump into Segment 3 dewatering well and successful dewatering of Segment 3.
- Installation of heat trace on all water transport lines and lines insulated. Also, heaters have been added to water tanks T-6 and T-7.
- Installation has been completed of 39.37 tons of iron, provided by Peerless Metal Powder, and 11.5 tons of sand, provided by Martin Marietta Material, into the PRGS vessel.

Attachment 1



LEGEND

- EXISTING THIRD SITE HDPE PIPING
- EXISTING SHEETPILE WALL

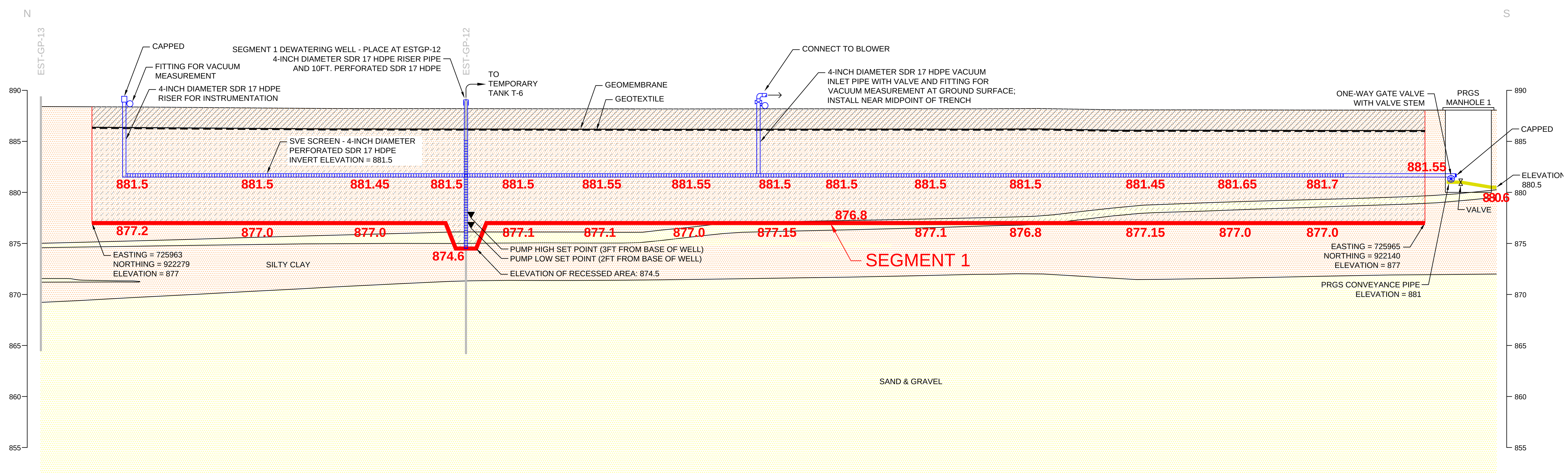
NOTES:

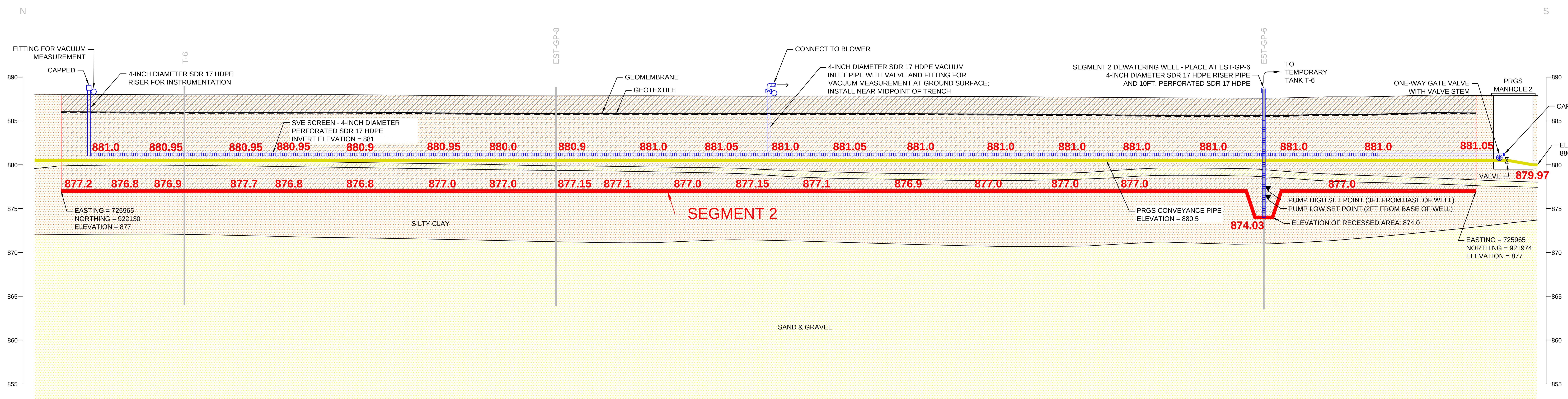
1. SITE PLAN DIMENSIONS BASED ON SURVEYS BY THE SCHNEIDER CORPORATION AND AVAILABLE SITE MEASUREMENTS.

ENVIRON

SUPPORT FACILITIES PLAN
ENVIRO-CHEM SUPERFUND SITE
985 S. US. HIGHWAY 421
ZIONSVILLE, INDIANA

DATE:	CONTRACT NUMBER:	FIGURE
04/28/09	21-6585K	C-2
DRAFTER: APR/ELS	APPROVED:	REVISED: REVISION 3





LEGEND

- WIDENED SECTION WITH COMPACTED CLEAN SILTY CLAY FILL
- FREE DRAINING 1- TO 2-INCH STONE
- BOTTOM ELEVATION OF AUGMENTED SVE TRENCH SEGMENT

HORIZONTAL SCALE (FT.)
0 6

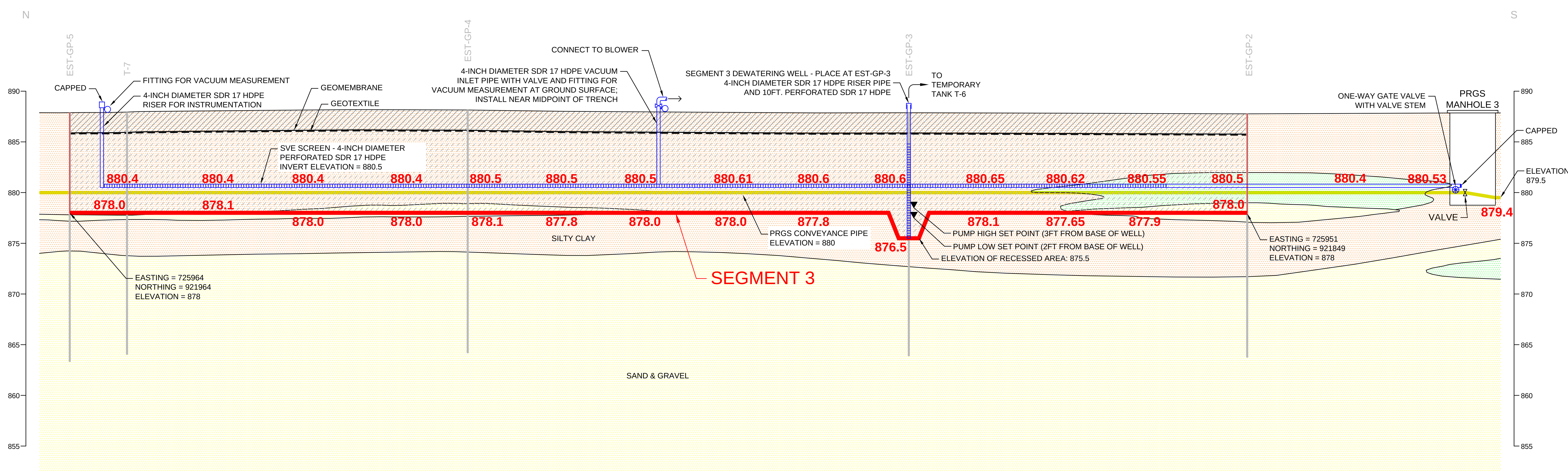
NOTES:

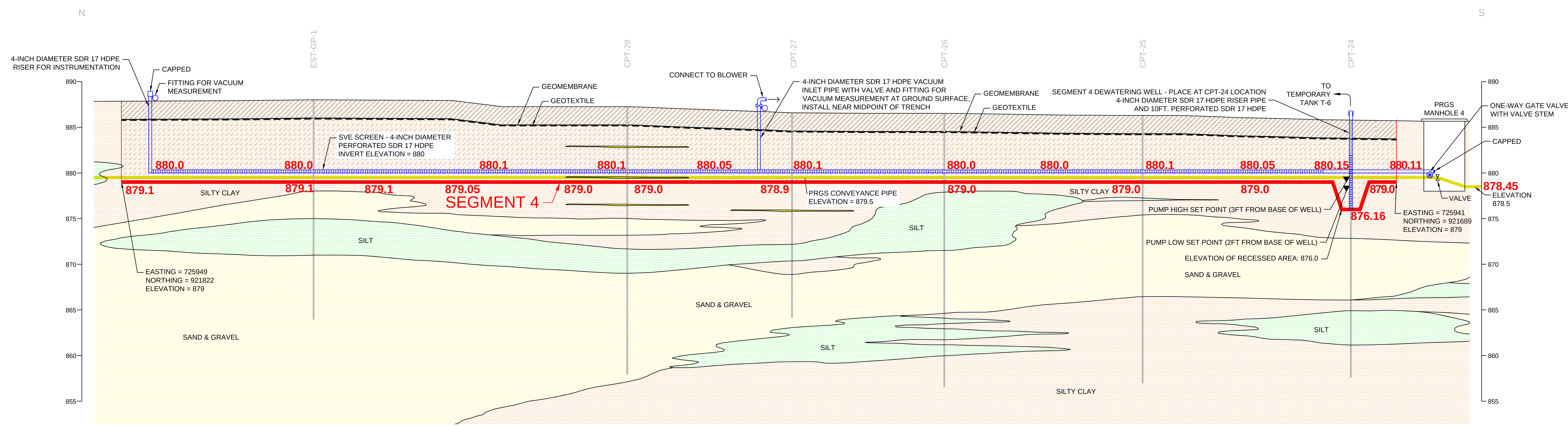
1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. ACCURACY OF GEOLOGIC CROSS SECTION LIMITED TO CONE PENETRATION TESTING (CPT) AND GEOPROBE DATA POINTS. CPT DATA WERE COLLECTED IN JUNE 2002 AND GEOPROBE BORINGS WERE INSTALLED AND LOGGED IN JUNE 2002. CPT AND GEOPROBE DATA WERE PRESENTED IN A JUNE 24, 2002 ENVIRON LETTER REPORT TO THE USEPA. INTERPRETATION OF THE SOIL PROFILE BETWEEN THE DATA POINTS HAS BEEN PROVIDED FOR VISUALIZATION PURPOSES, BUT SIGNIFICANT VARIATIONS FROM THE INTERPRETATION ARE POSSIBLE AND SHOULD BE EXPECTED.
3. PRGS CONVEYANCE PIPING IS 4-INCH DIAMETER SDR 17 HDPE (NON-SLOTTED).
4. PUMP HIGH SET POINT MAY BE ADJUSTED ON FIELD CONDITIONS.

ENVIRON

AS-BUILT CONDITIONS
AUGMENTED SVE TRENCH CROSS-SECTION AND PROFILE - SEGMENTS 1 AND 2
ENVIRO-CHEM SUPERFUND SITE
985 S. US. HIGHWAY 421
ZIONSVILLE, INDIANA

DATE:	CONTRACT NUMBER:		FIGURE
04/28/09	21-6585K		C-5
DRAFTER:	APPROVED:	REVISED:	
APR/ELS		REVISION 3	





LEGEND

- WIDENED SECTION WITH COMPACTED CLEAN SILTY CLAY FILL
- FREE DRAINING 1- TO 2-INCH STONE
- BOTTOM ELEVATION OF AUGMENTED SVE TRENCH SEGMENT

HORIZONTAL SCALE (FT.)
0 6

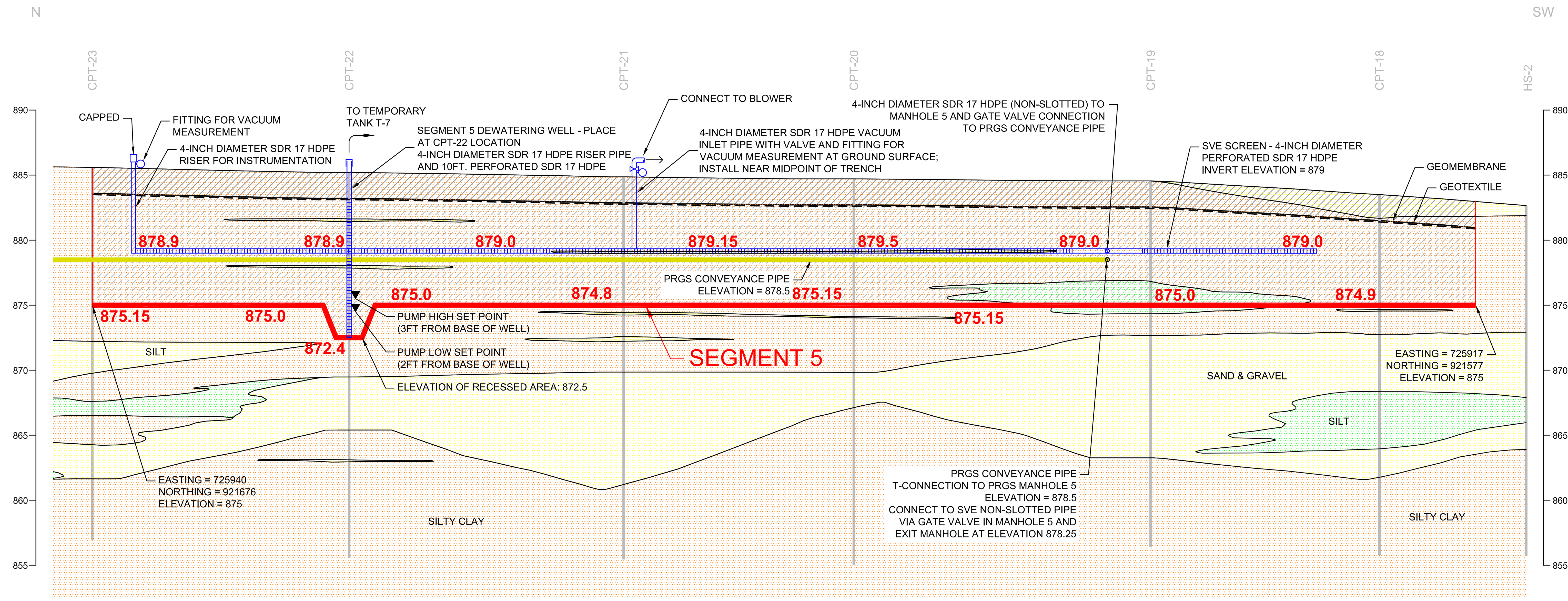
NOTES:

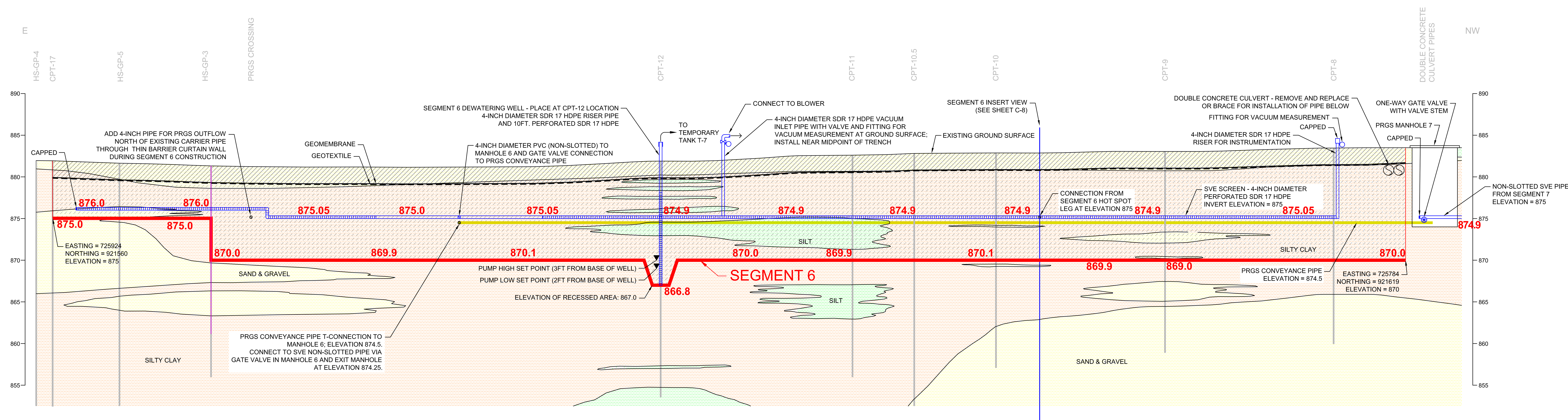
1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. ACCURACY OF GEOLOGIC CROSS SECTION LIMITED TO CONE PENETRATION TESTING (CPT) AND GEOPROBE DATA POINTS. CPT DATA WERE COLLECTED IN JUNE 2002 AND GEOPROBE BORINGS WERE INSTALLED AND LOGGED IN JUNE 2002. CPT AND GEOPROBE DATA WERE PRESENTED IN A JUNE 24, 2002 ENVIRON LETTER REPORT TO THE USEPA. INTERPRETATION OF THE SOIL PROFILE BETWEEN THE DATA POINTS HAS BEEN PROVIDED FOR VISUALIZATION PURPOSES, BUT SIGNIFICANT VARIATIONS FROM THE INTERPRETATION ARE POSSIBLE AND SHOULD BE EXPECTED.
3. PRGS CONVEYANCE PIPING IS 4-INCH DIAMETER SDR 17 HDPE (NON-SLOTTED).
4. PUMP HIGH SET POINT MAY BE ADJUSTED ON FIELD CONDITIONS.

ENVIRON

AS-BUILT CONDITIONS
AUGMENTED SVE TRENCH CROSS-SECTION AND PROFILE - SEGMENTS 3 AND 4
ENVIRO-CHEM SUPERFUND SITE
985 S. US. HIGHWAY 421
ZIONSVILLE, INDIANA

DATE:	CONTRACT NUMBER:		FIGURE
04/28/09	21-6585K		C-6
DRAFTER:	APPROVED:	REVISED:	
APR/ELS		REVISION 3	





LEGEND

- WIDENED SECTION WITH COMPACTED CLEAN SILTY CLAY FILL
- FREE DRAINING 1- TO 2-INCH STONE
- BOTTOM ELEVATION OF AUGMENTED SVE TRENCH SEGMENT

HORIZONTAL SCALE (FT.)
0 6

NOTES:

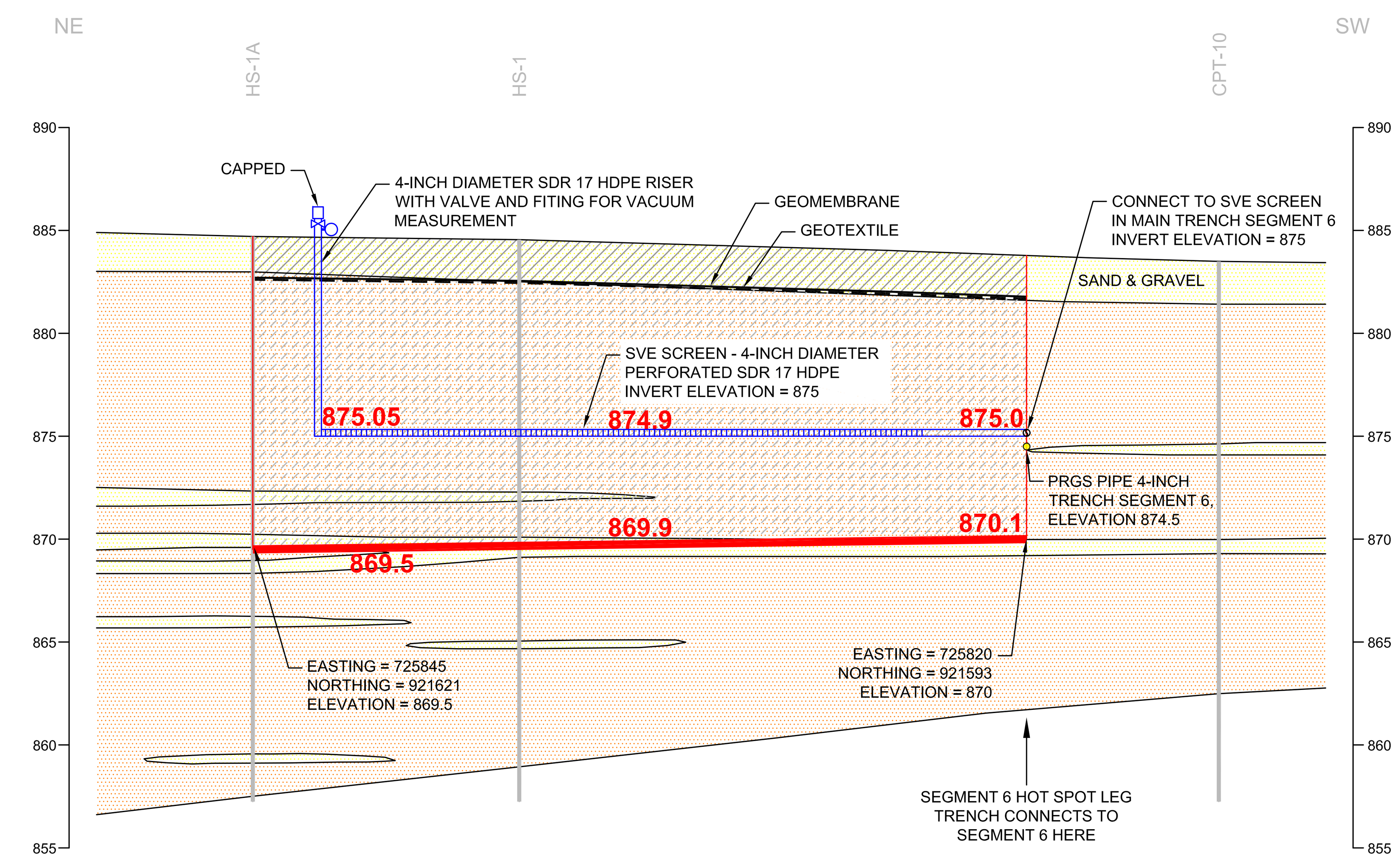
1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. ACCURACY OF GEOLOGIC CROSS SECTION LIMITED TO CONE PENETRATION TESTING (CPT) AND GEOPROBE DATA POINTS. CPT DATA WERE COLLECTED IN JUNE 2002 AND GEOPROBE BORINGS WERE INSTALLED AND LOGGED IN JUNE 2002. CPT AND GEOPROBE DATA WERE PRESENTED IN A JUNE 24, 2002 ENVIRON LETTER REPORT TO THE USEPA. INTERPRETATION OF THE SOIL PROFILE BETWEEN THE DATA POINTS HAS BEEN PROVIDED FOR VISUALIZATION PURPOSES, BUT SIGNIFICANT VARIATIONS FROM THE INTERPRETATION ARE POSSIBLE AND SHOULD BE EXPECTED.
3. PRGS CONVEYANCE PIPING IS 4-INCH DIAMETER SDR 17 HDPE (NON-SLOTTED).
4. PUMP HIGH SET POINT MAY BE ADJUSTED ON FIELD CONDITIONS.

ENVIRON

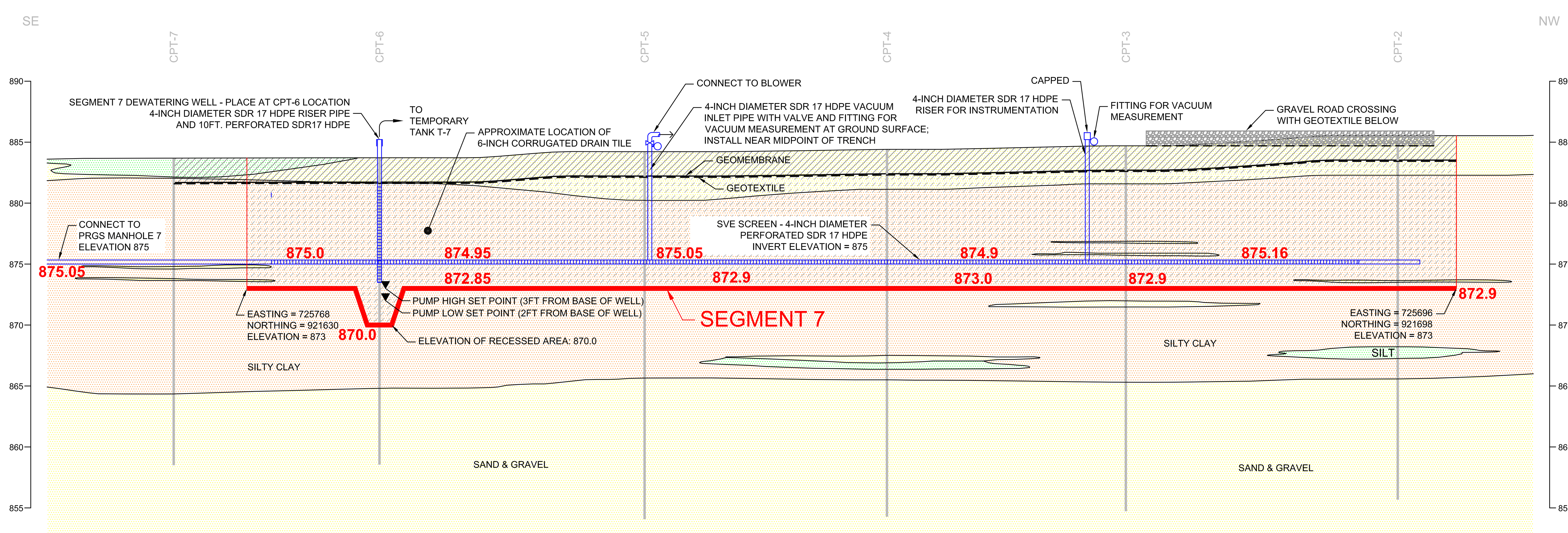
AS-BUILT CONDITIONS
AUGMENTED SVE TRENCH CROSS-SECTION AND PROFILE - SEGMENTS 5 AND 6

ENVIRO-CHEM SUPERFUND SITE
985 S. US. HIGHWAY 421
ZIONSVILLE, INDIANA

DATE:	CONTRACT NUMBER:		FIGURE
04/29/09	21-6585K		C-7
DRAFTER:	APPROVED:	REVISED:	
APR/ELS		REVISION 3	



SEGMENT 6 (HOT SPOT) INSERT VIEW



LEGEND

- WIDENED SECTION WITH COMPACTED CLEAN SILTY CLAY FILL
- FREE DRAINING 1- TO 2-INCH STONE
- BOTTOM ELEVATION OF AUGMENTED SVE TRENCH SEGMENT

HORIZONTAL SCALE (FT.)
0 6

NOTES:

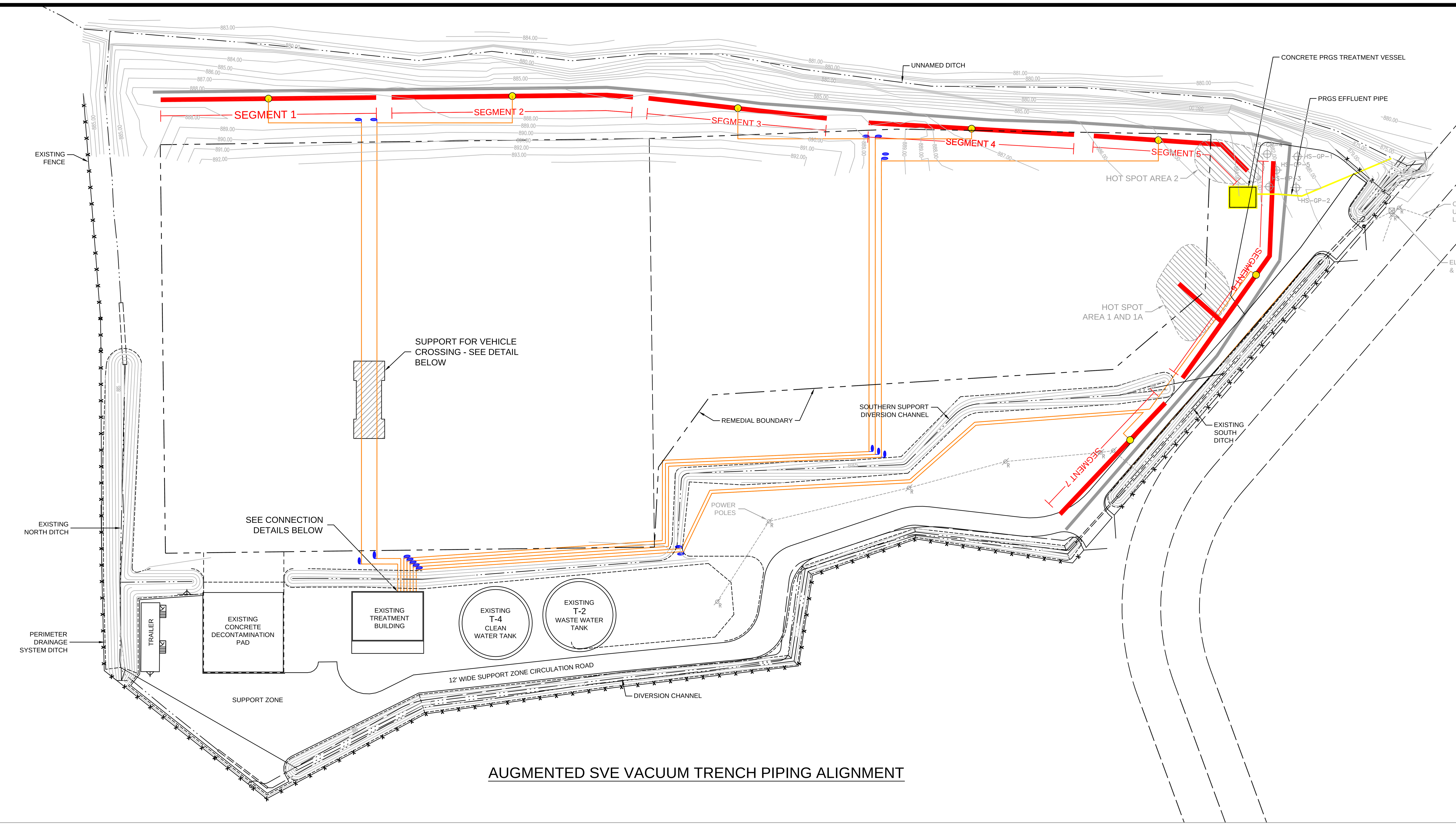
1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. ACCURACY OF GEOLOGIC CROSS SECTION LIMITED TO CONE PENETRATION TESTING (CPT) AND GEOPROBE DATA POINTS. CPT DATA WERE COLLECTED IN JUNE 2002 AND GEOPROBE BORINGS WERE INSTALLED AND LOGGED IN JUNE 2002. CPT AND GEOPROBE DATA WERE PRESENTED IN A JUNE 24, 2002 ENVIRON LETTER REPORT TO THE USEPA. INTERPRETATION OF THE SOIL PROFILE BETWEEN THE DATA POINTS HAS BEEN PROVIDED FOR VISUALIZATION PURPOSES, BUT SIGNIFICANT VARIATIONS FROM THE INTERPRETATION ARE POSSIBLE AND SHOULD BE EXPECTED.
3. PRGS CONVEYANCE PIPING IS 4-INCH DIAMETER SDR 17 HDPE (NON-SLOTTED).
4. PUMP HIGH SET POINT MAY BE ADJUSTED ON FIELD CONDITIONS.

ENVIRON

AS-BUILT CONDITIONS AUGMENTED SVE TRENCH CROSS-SECTION AND PROFILE - SEGMENT 6 LEG AND SEGMENT 7

ENVIRO-CHEM SUPERFUND SITE
985 S. US. HIGHWAY 421
ZIONSVILLE, INDIANA

DATE:	CONTRACT NUMBER:		FIGURE
04/29/09	21-6585K		C-8
DRAFTER:	APPROVED:	REVISED:	
APR/ELS		REVISION 3	



E N S W

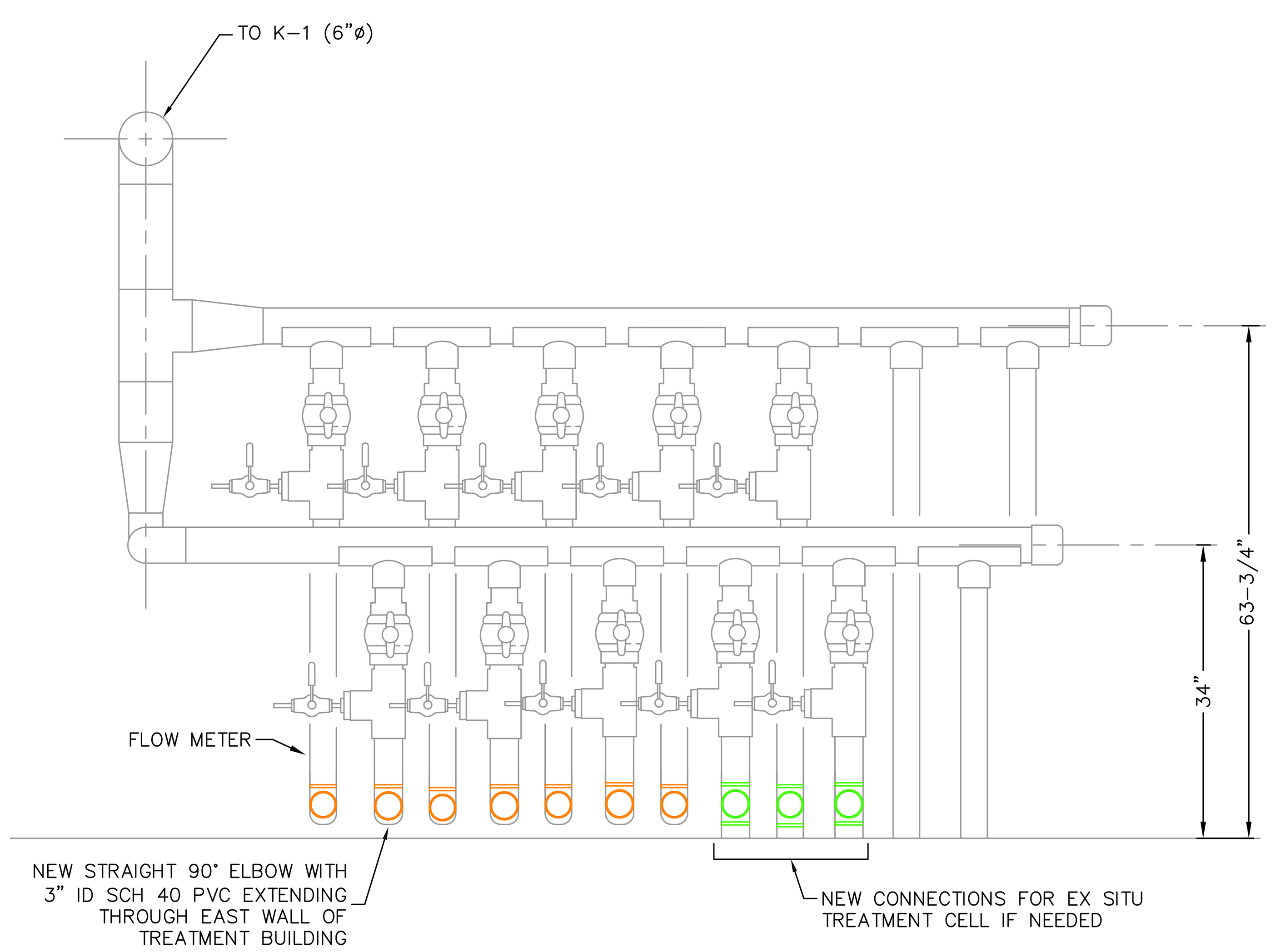
LEGEND

- AUGMENTED SEGMENTED SVE TRENCH
- THIN BARRIER CURTAIN WALL
- APPROXIMATE LOCATION OF INLET PIPE FROM BLOWER
- 4-INCH DIAMETER SDR 17 HDPE PIPING FROM VACUUM INLET PIPE RISER TO TREATMENT BUILDING - ABOVE GROUND (APPROXIMATE LOCATION)
- CONDENSATE TRAP AND DRAIN; PLACE AT LOW SPOTS IN ALIGNMENT - SUGGESTED LOCATIONS SHOWN: SLOPE PIPE TO ALLOW CONDENSATE TO DRAIN

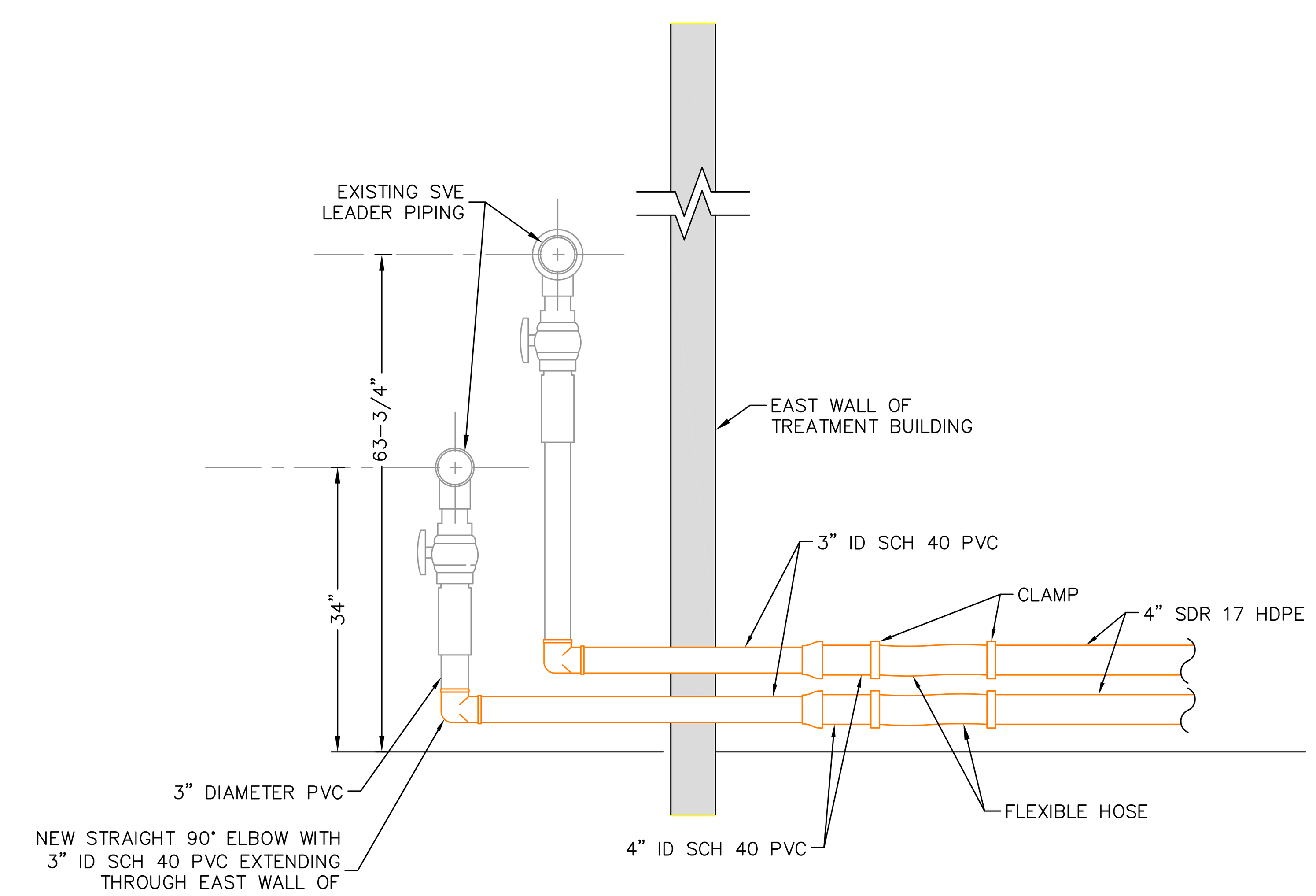
NOTE: SITE PLAN DIMENSIONS BASED ON SURVEYS BY THE SCHNEIDER CORPORATION AND AVAILABLE SITE MEASUREMENTS.

SCALE IN FEET
40 0 20 40 80

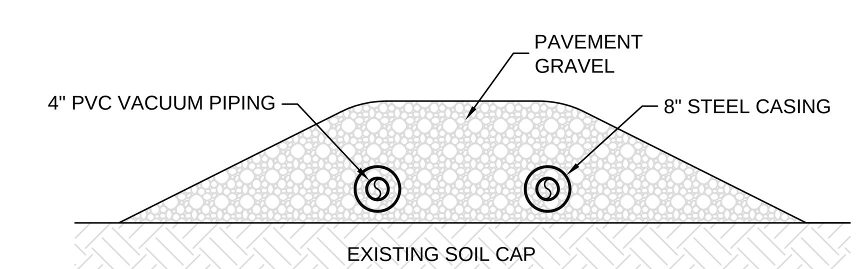
AUGMENTED SVE VACUUM TRENCH PIPING ALIGNMENT



AUGMENTED SVE VACUUM PIPE CONNECTION AT TREATMENT BUILDING – FRONT VIEW
NOT TO SCALE



AUGMENTED SVE VACUUM PIPE CONNECTION AT TREATMENT BUILDING – SIDE VIEW
NOT TO SCALE



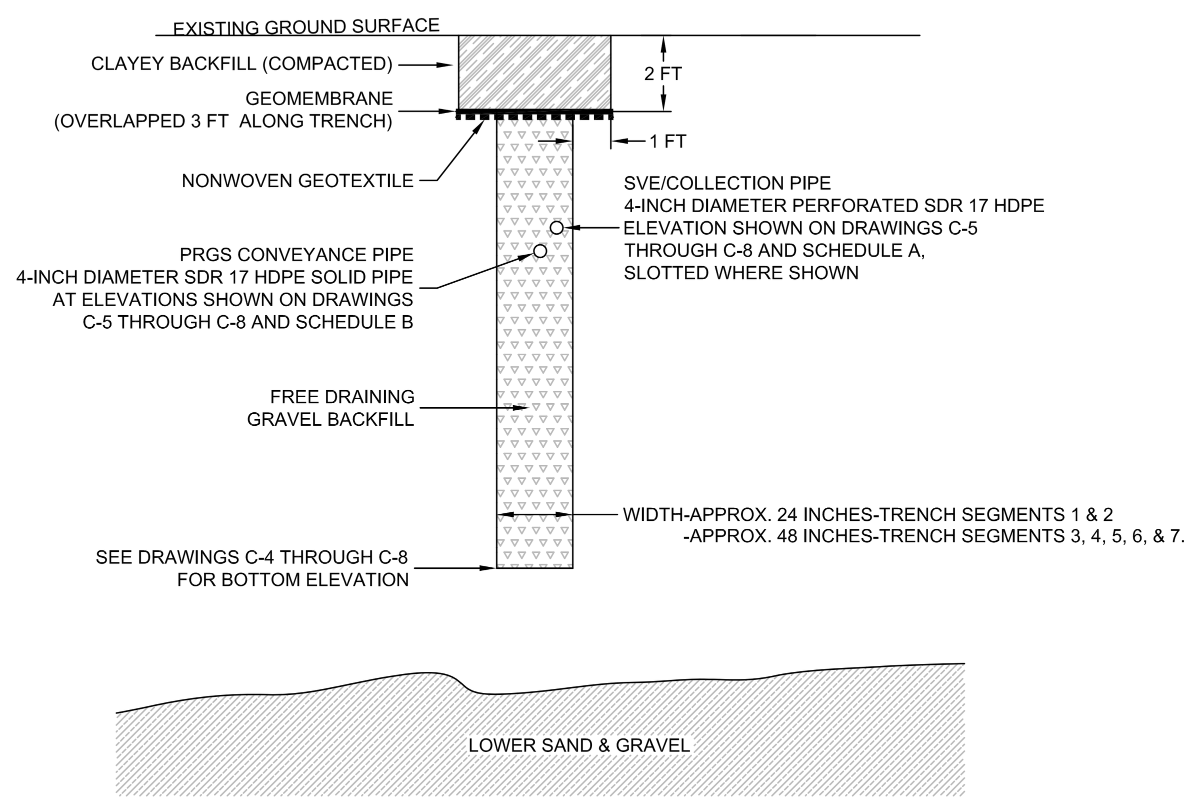
VEHICLE CROSSOVER PROTECTION
NOT TO SCALE

ENVIRON

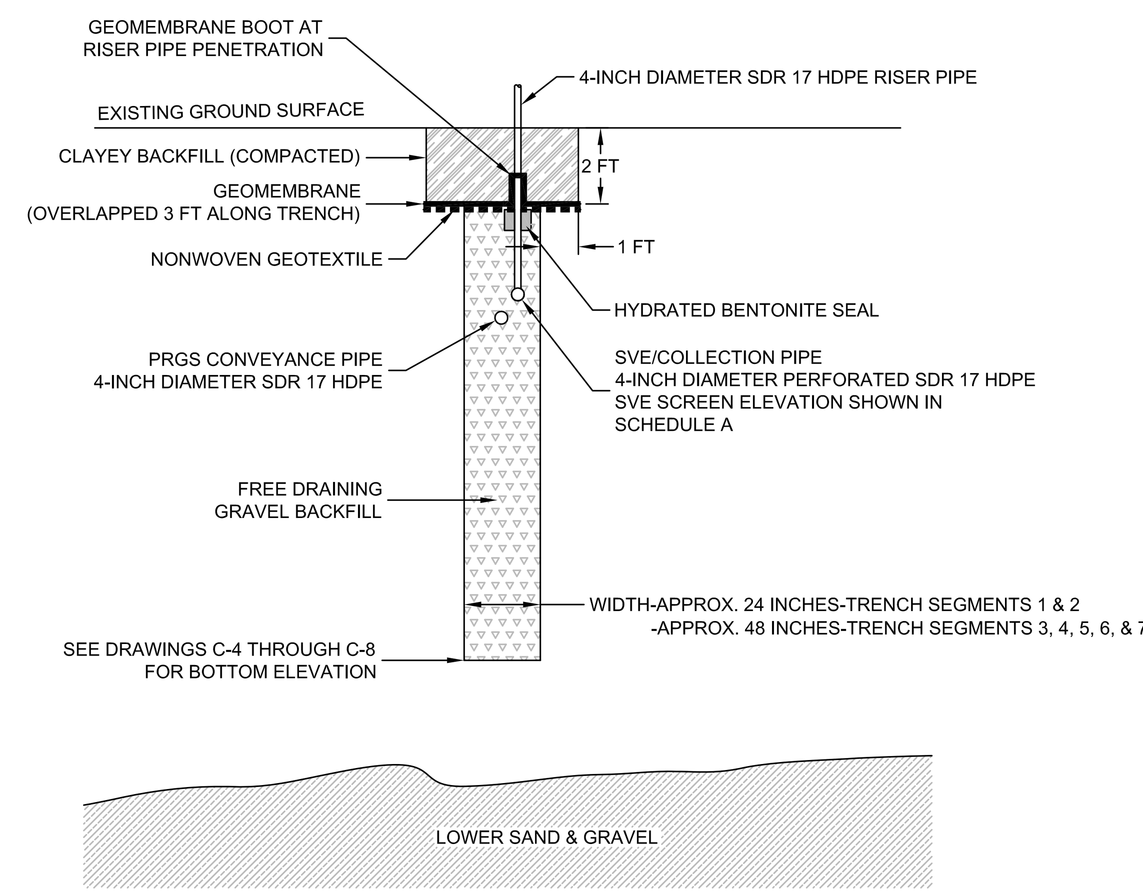
AS-BUILT CONDITIONS AUGMENTED SVE SYSTEM PIPELINE ALIGNMENT AND CONNECTION AT TREATMENT BUILDING

ENVIRO-CHEM SUPERFUND SITE
985 S. US. HIGHWAY 421
ZIONSVILLE, INDIANA

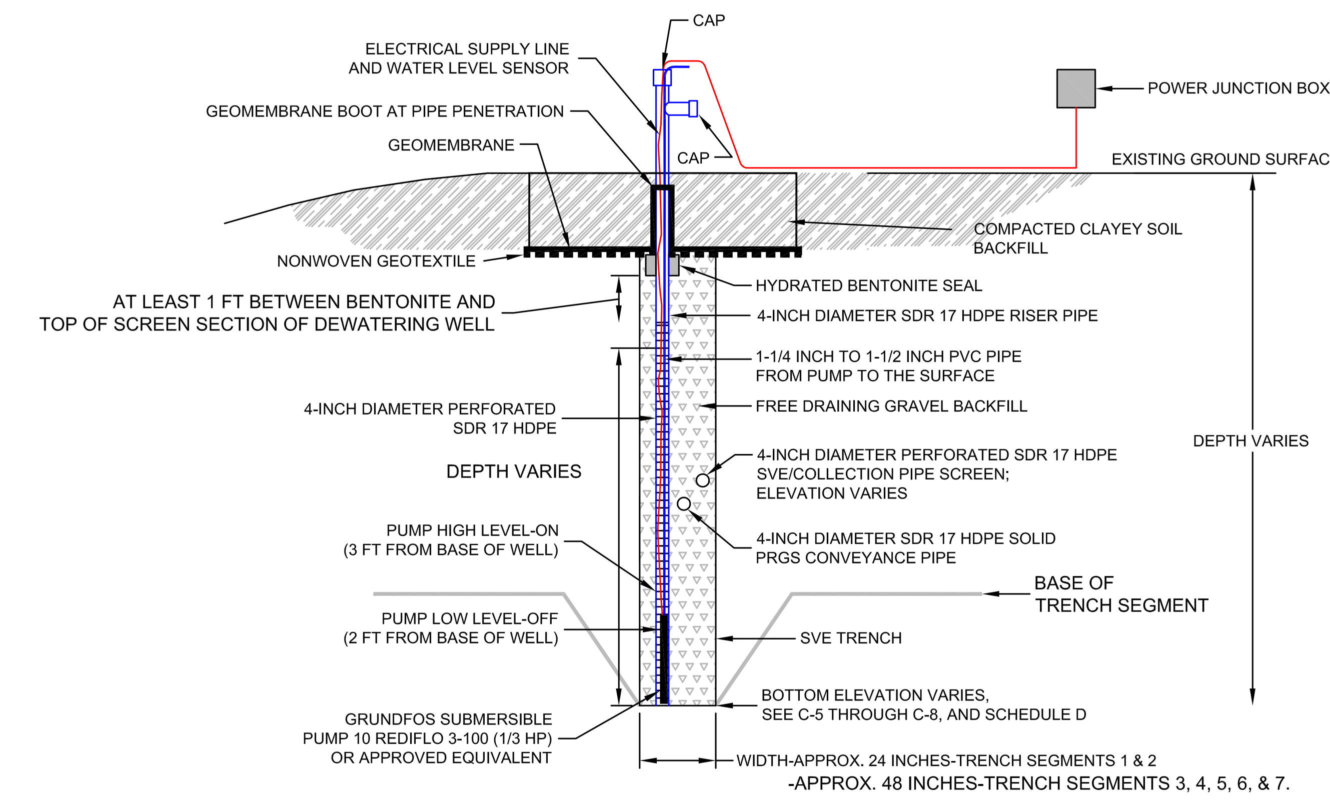
DATE:	CONTRACT NUMBER:		FIGURE
04/29/09	21-6585K		C-9
DRAFTER:	APPROVED:	REVISED:	
APR/ELS		REVISION 3	



TYPICAL AUGMENTED SVE TRENCH SECTION
SCALE: 1" = 4'



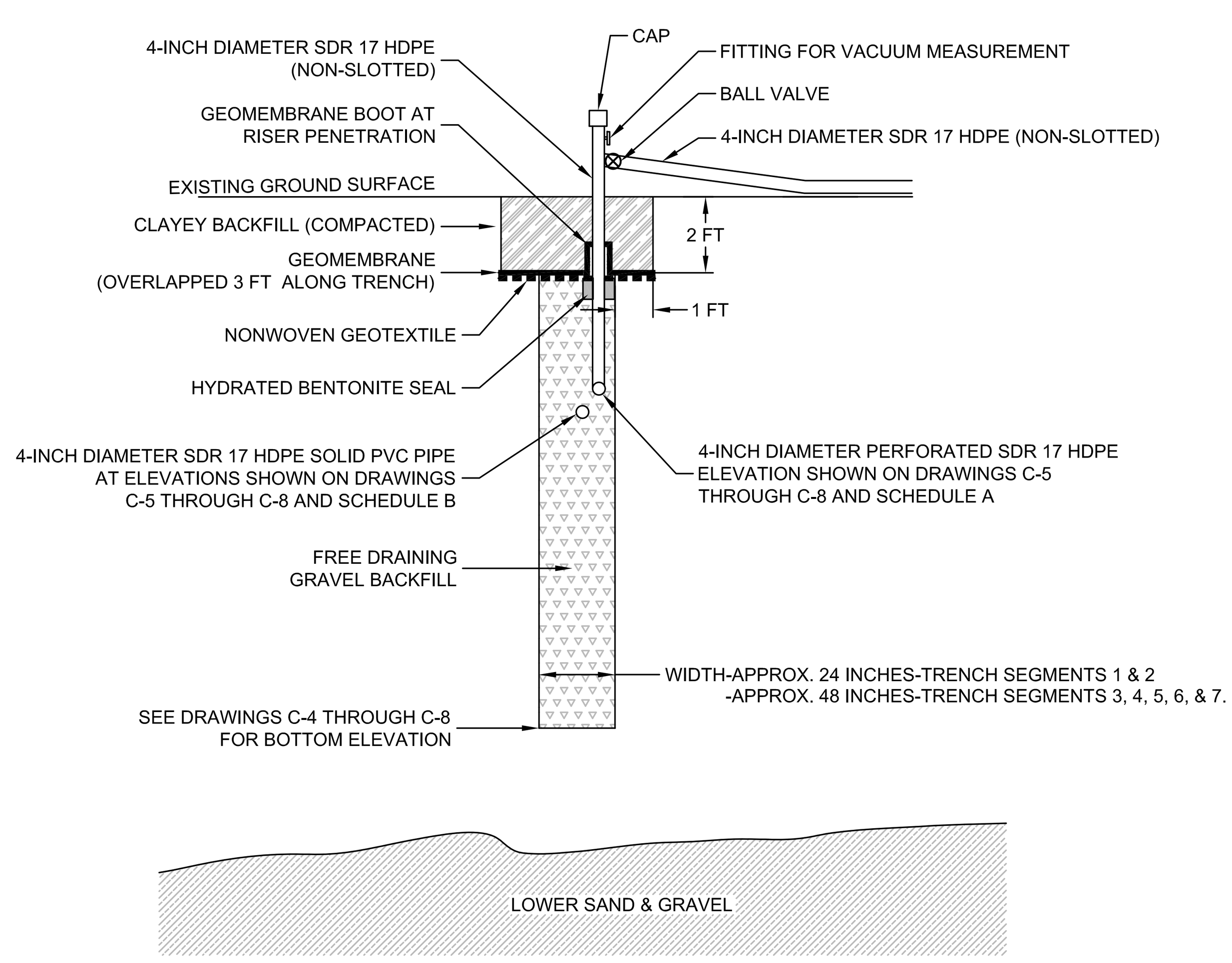
TYPICAL AUGMENTED SVE TRENCH SECTION
WITH SVE INSTRUMENTATION RISER
SCALE: 1" = 4'



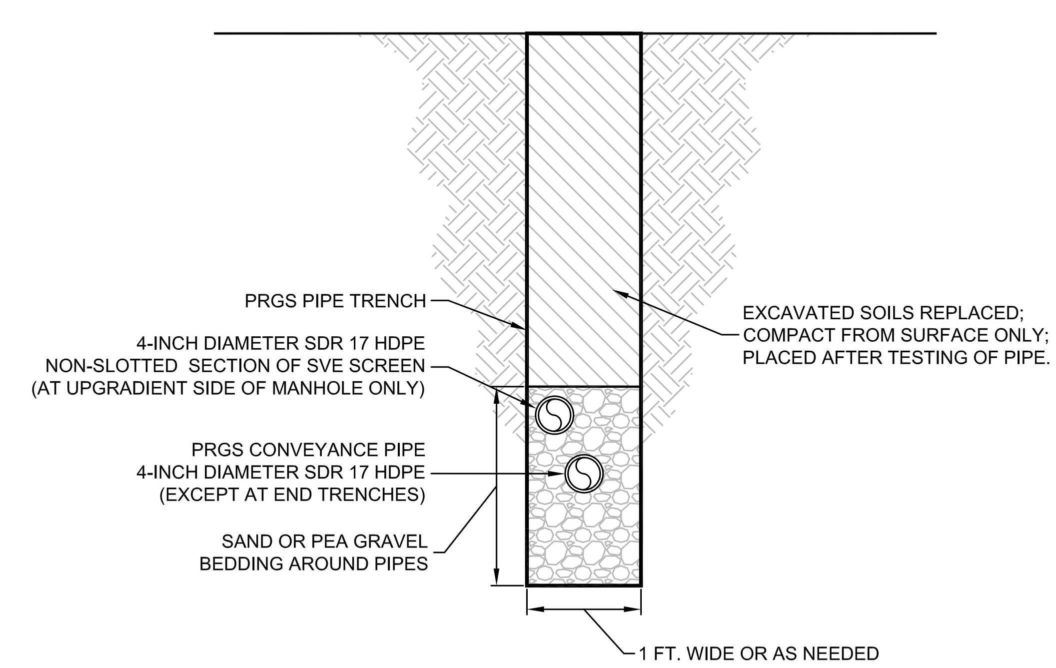
TYPICAL AUGMENTED SVE TRENCH SECTION WITH
DEWATERING WELL
SCALE: 1" = 4'

NOTES:

1. DEWATERING WELL SCREEN BASE SET AT BOTTOM OF TRENCH.
2. PUMP HIGH/LOW CONTROLLED BY GRUNDFOS CU300 AND WIKA TYPE LS-10 LIQUID LEVEL TRANSMITTER (#4262779) OR EQUIVALENT.



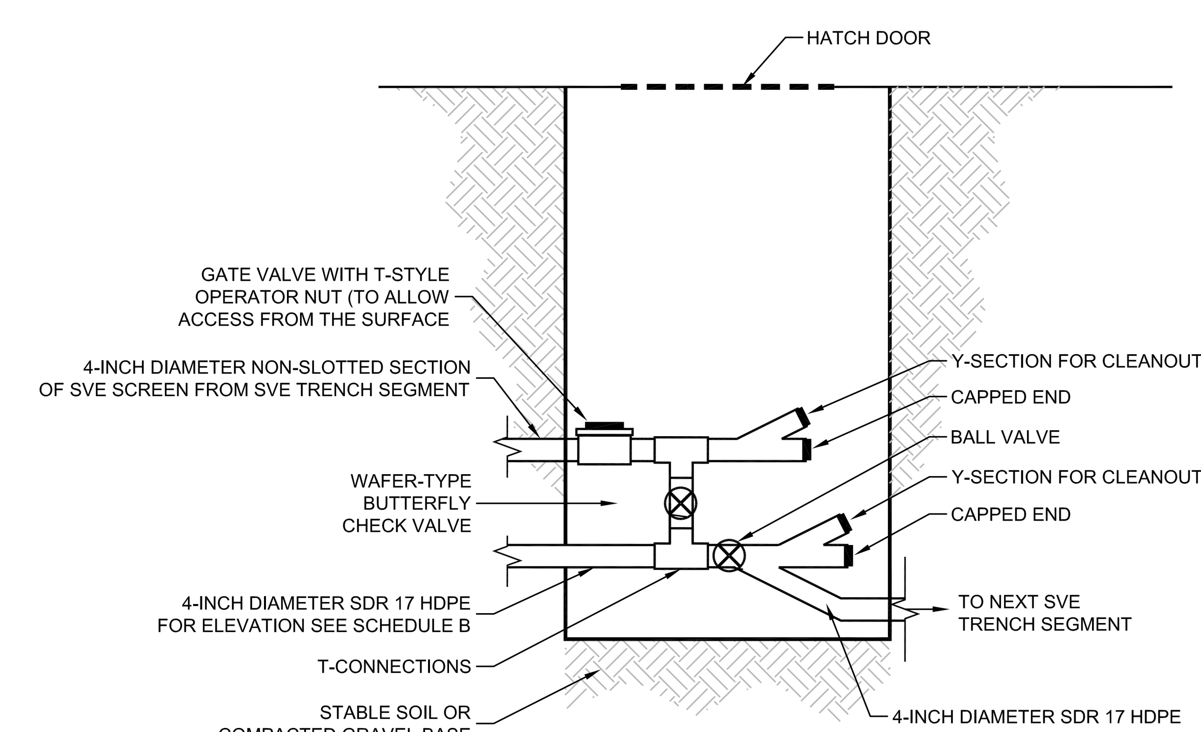
TYPICAL AUGMENTED SVE TRENCH SECTION WITH
VACUUM INLET RISER
SCALE: 1" = 4'



PRGS CONVEYANCE PIPE TRENCH (BETWEEN SEGMENTS)
NOT TO SCALE

NOTE:

1. ADD 1 FOOT BENTONITE AROUND PIPE PENETRATION AT ENDS OF TRENCH SEGMENTS.

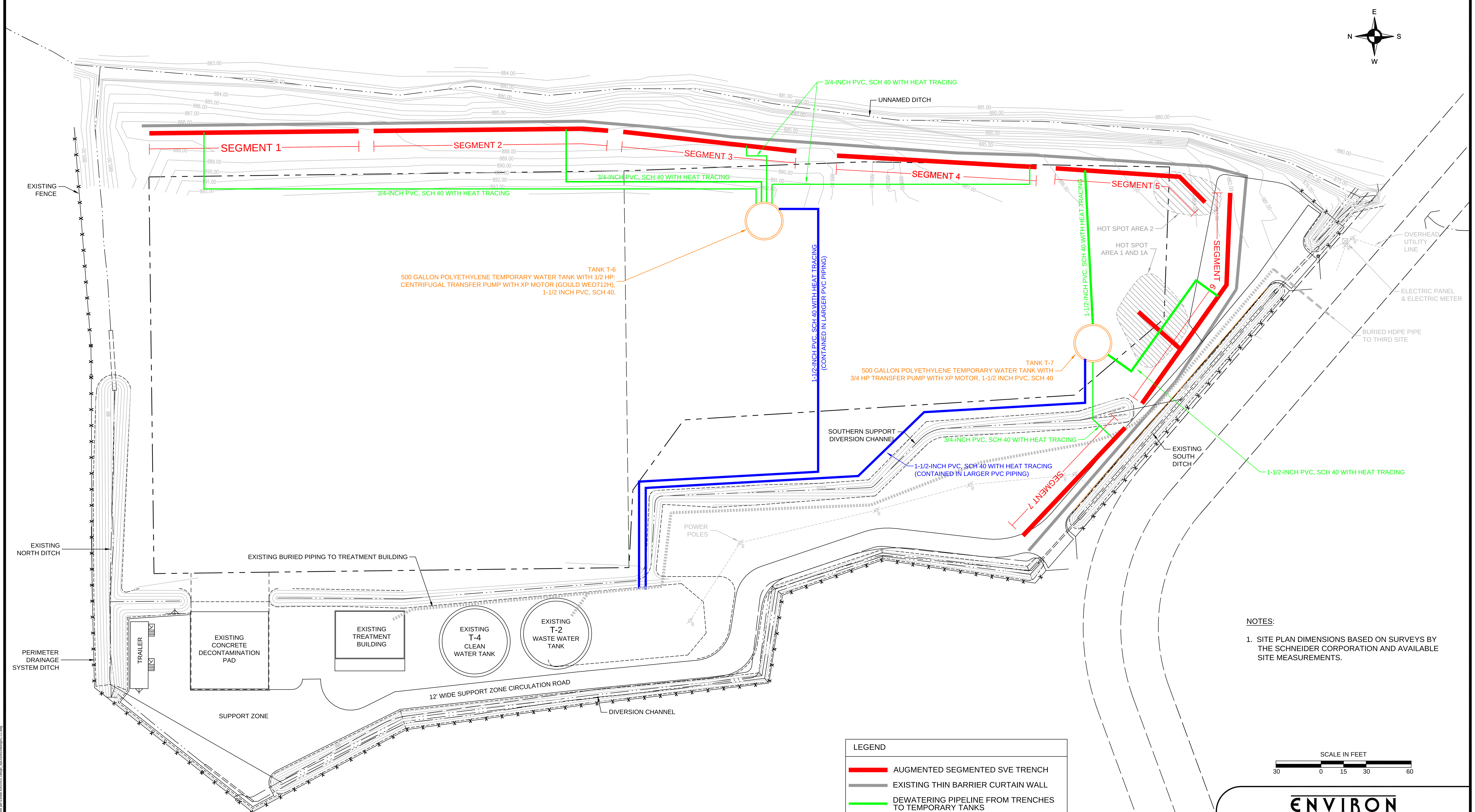


TYPICAL PRGS MANHOLE
NOT TO SCALE

ENVIRON

AS-BUILT CONDITIONS
AUGMENTED SVE TRENCH DETAILS AND CONNECTION TO PRGS CONVEYANCE PIPE
ENVIRO-CHEM SUPERFUND SITE
985 S. US. HIGHWAY 421
ZIONSVILLE, INDIANA

DATE:	CONTRACT NUMBER:		FIGURE
04/29/09	21-6585K		C-10
DRAFTER: APR/ELS	APPROVED:	REVISED: REVISION 3	



NOTES:

1. SITE PLAN DIMENSIONS BASED ON SURVEYS BY THE SCHNEIDER CORPORATION AND AVAILABLE SITE MEASUREMENTS.

SCALE IN FEET

30 0 15 30 60

LEGEND

- AUGMENTED SEGMENTED SVE TRENCH
- EXISTING THIN BARRIER CURTAIN WALL
- DEWATERING PIPELINE FROM TRENCHES TO TEMPORARY TANKS
- DEWATERING PIPELINE FROM TEMPORARY TANKS TO TANK T-2
- EXISTING THIRD SITE HDPE PIPING

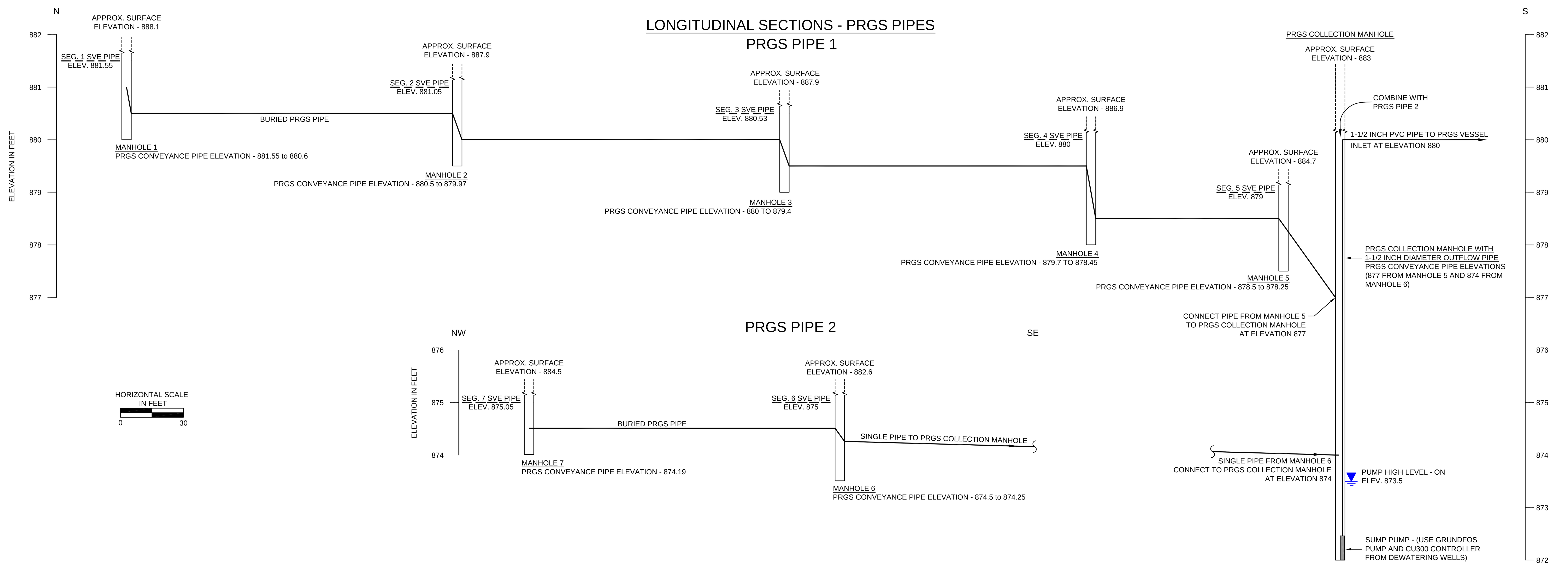
ENVIRON

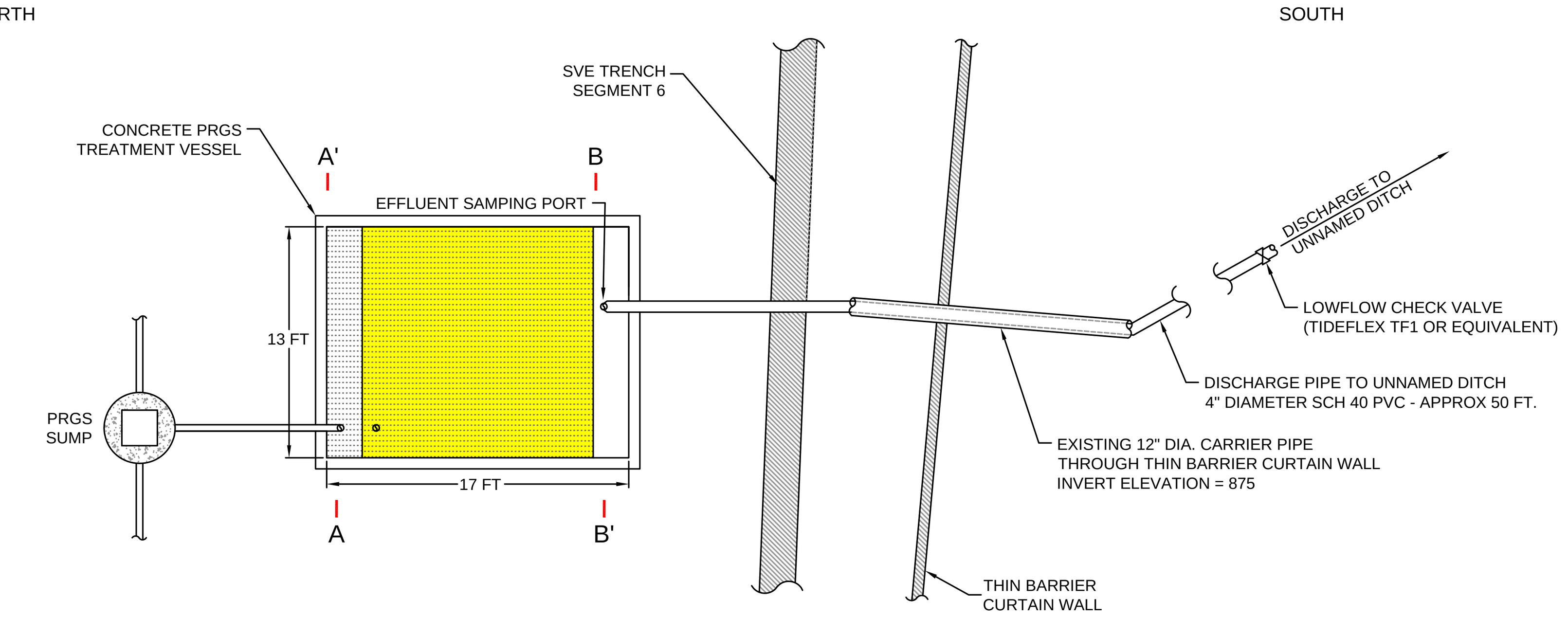
AS-BUILT CONDITIONS
AUGMENTED SVE DEWATERING SYSTEM
PIPELINE ALIGNMENT

ENVIRO-CHEM SUPERFUND SITE
985 S. US. HIGHWAY 421
ZIONSVILLE, INDIANA

DATE:	CONTRACT NUMBER:		FIGURE
04/28/09	21-6585K		C-11
DRAFTER:	APPROVED:	REVISED:	
APR/ELS		REVISION 3	

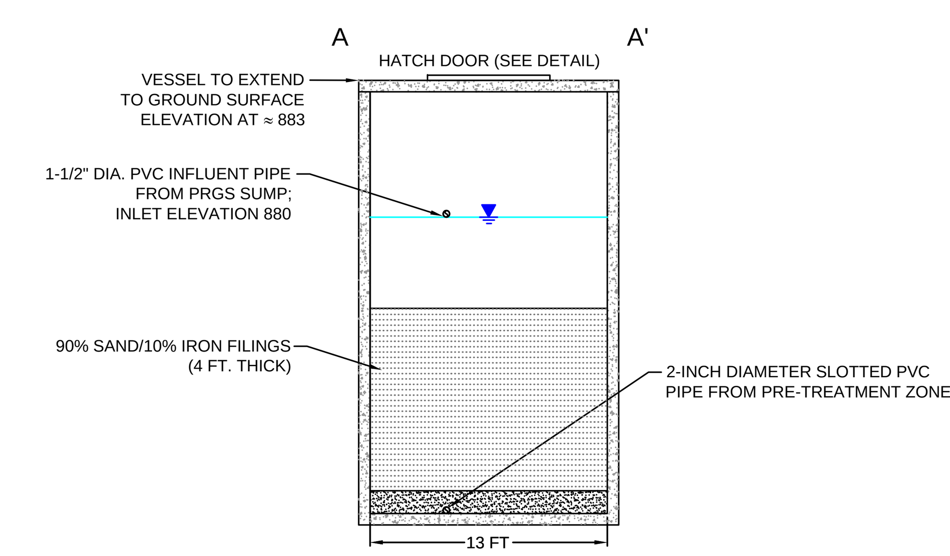
LONGITUDINAL SECTIONS - PRGS PIPES





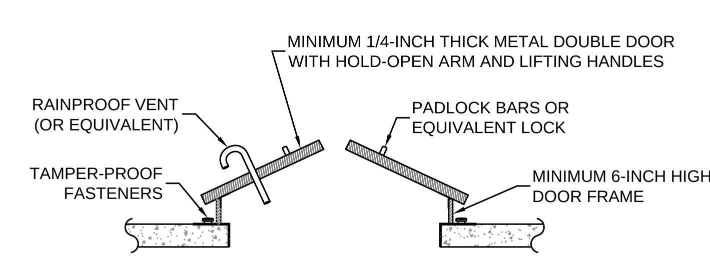
PERMEABLE REACTIVE GATE SYSTEM SCHEMATIC PLAN VIEW

NOT TO SCALE



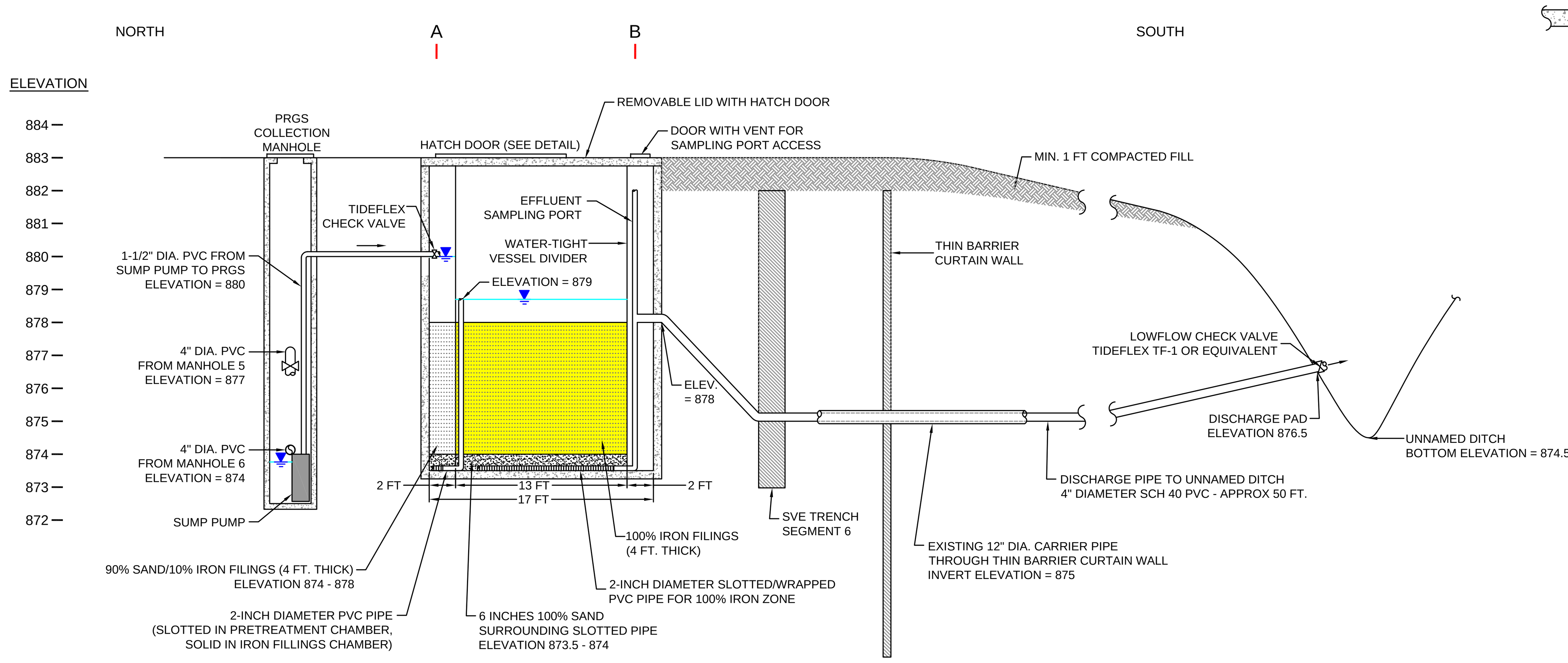
PERMEABLE REACTIVE GATE TREATMENT SYSTEM SCHEMATIC CROSS-SECTION A-A'

NOT TO SCALE



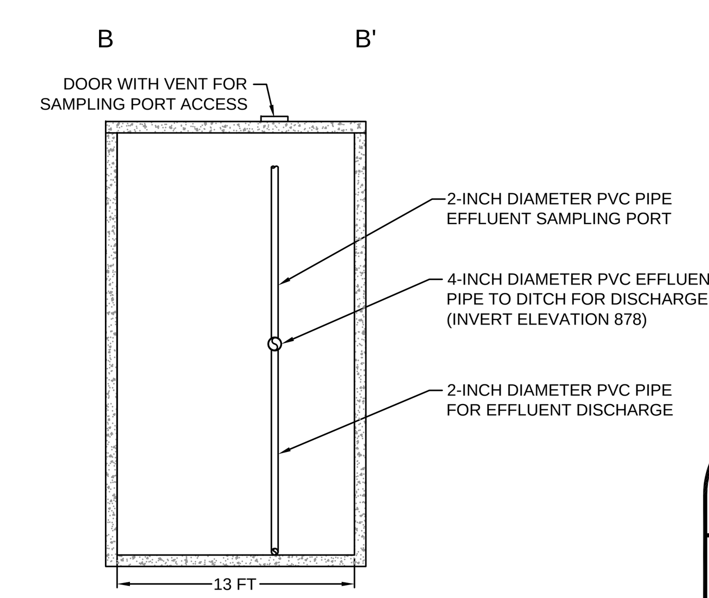
HATCH DOOR DETAIL

NOT TO SCALE



PERMEABLE REACTIVE GATE SYSTEM SCHEMATIC CROSS-SECTION VIEW

NOT TO SCALE - SEE SPECIFICATION 2206



PERMEABLE REACTIVE GATE TREATMENT SYSTEM SCHEMATIC CROSS-SECTION B-B'

NOT TO SCALE

ENVIRON

PERMEABLE REACTIVE GATE SYSTEM SECTIONS AND PIPING

ENVIRO-CHEM SUPERFUND SITE
985 S. US. HIGHWAY 421
ZIONSVILLE, INDIANA

DATE:	CONTRACT NUMBER:		FIGURE
04/28/09	21-6585K		C-12
DRAFTER:	APPROVED:	REVISED:	
APR/ELS		REVISION 3	

Attachment 2

LIMITED WARRANTY

Products manufactured by GRUNDFOS are warranted to the original user only to be free of defects in material and workmanship for a period of 18 months from date of installation, but not more than 24 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS factory or authorized service station, any product of GRUNDFOS manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

MANUFACTURER WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE. EXCEPT AS EXPRESSLY HEREIN PROVIDED THE GOODS ARE SOLD "AS IS", THE ENTIRE RISK AS TO QUALITY AND FITNESS FOR A PARTICULAR PURPOSE, AND PERFORMANCE OF THE GOODS IS WITH THE BUYER, AND SHOULD THE GOODS PROVE DEFECTIVE FOLLOWING THEIR PURCHASE, THE BUYER AND NOT THE MANUFACTURER, DISTRIBUTOR, OR RETAILER ASSUMES THE ENTIRE RISK OF ALL NECESSARY SERVICING OR REPAIR.

Some jurisdictions do not allow the exclusion or limitation of implied warranties of merchantability and fitness for a particular purpose, of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last or require you to pay certain expenses as set forth above. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

The telephone number of our service and repair facilities central directory, from which you can obtain the locations of our service and repair facilities is, 1-800-333-1366.

Federal Communications Commission Notice:
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

GRUNDFOS®

Leaders in Pump Technology

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L-RF-IO-008 Rev.2/00
PRINTED IN USA

Redi-Flo3

SQE-NE Environmental Pumps

Installation and Operating Instructions

- **Efficient Permanent Magnet Motor**
- **High Starting Torque**
- **Soft Start**
(2 seconds to reach maximum rpm, and maximum pressure)
- **Built-in "Smart" Motor Protection with automatic restart**
- **Communication Through the Redi-Flo3 Status Box**
- **Integrated Protection Against Adverse Conditions**
- **Environmental Materials of Construction**

Please leave these instructions with the pump for future reference

GRUNDFOS®

Leaders in Pump Technology

SAFETY WARNING

Electrical Work

WARNING: To reduce the risk of electric shock during operation of this pump requires the provision of acceptable grounding. If the means of connection to the supply connected box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor (at least the size of the circuit supplying the pump) to the grounding screw provided within the wiring compartment.

Pre-Installation Checklist

1. Well Preparation

If the pump is to be installed in a new well then the well should be fully developed and bailed or blown free of cuttings and sand. The construction of the GRUNDFOS Redi-Flo3 submersibles makes it resistant to abrasion; however, no pump made of any material can forever withstand the destructive wear that occurs when constantly pumping sandy water.

2. Make Sure You Have the Right Pump

Determine the maximum depth of the well, and the drawdown level at the pump's maximum capacity. Pump selection and setting depth should be made based on this data.

3. Pumped Fluid Requirements

Submersible well pumps are designed for pumping turbid free, cool water; free of air or gases. Possible decreased pump performance and life expectancy can occur when operating in conditions outside of this chemistry. Water temperature ideally should not exceed 104°F. Extended pump life and optimal performance can best be obtained through proper well development and in the case of higher fluid temperatures use a cooling shroud.

A check should be made to ensure that the installation depth of the pump will always be at least three feet below the maximum drawdown level of the well (Fig.1). The bottom of the motor should never be installed lower than the bottom of the screen.

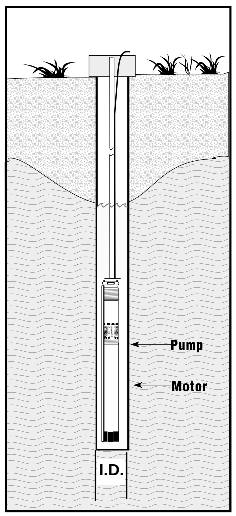


Fig. 1

4. Motor Cooling Requirements

To ensure proper motor cooling refer to the table below for minimum flow requirements:

Flow velocity past the motor	Maximum liquid temperature
0.0 f/s (free convection)	86° F(30°C)
Min. 0.5 f/s	104°F (40°C)

Pre-Installation Checklist

If the pump is to be installed horizontally, e.g. in a tank, and there is a risk that the pump might be covered by mud, it must be installed in a flow sleeve.

Liquid temperatures/cooling

Figure 2 shows an operating Redi-Flo3 pump installed in a well.

Figure 2 illustrates the following:

- Well diameter.
- Pump diameter.
- Temperature of pumped liquid.
- Flow past the motor to the pump strainer.

Note: The well diameter must be at least 3”. If there is a risk that the motor will be covered with sediment or the pumped fluid is at an elevated temperature then it is recommended the pump be placed in a Flow Sleeve. The motor should always be installed above the well screen.

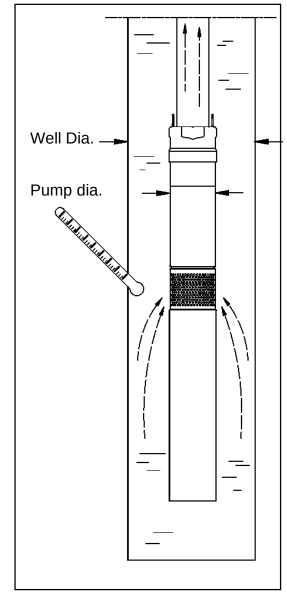


Fig. 2

5. Applications

Typical applications:

Environmental applications such as:

- Remediation pumping.
- Leachate recovery.
- Pollution recovery.
- Dewatering

6. Motor Preparation

GRUNDFOS MSE3-NE submersible motors have water-lubricated slide bearings. No additional lubrication is required.

The submersible motors are factory-filled with a special GRUNDFOS motor liquid (type SML 2), which will protect the motor fluid down to -4°F(20°C) and to prevent the growth of bacteria. The level of motor fluid is important for the operating life of the bearings and consequently the life of the motor.

Refilling of motor liquid

It is recommended to check and if needed, refill the motor with GRUNDFOS motor fluid SML 2.

Pre-Installation Checklist

To refill the motor, proceed as follows:

1. Remove the cable guard and separate the pump end from the motor.

2. Place the motor in vertical position with an inclination of approx. 10°.

3. Remove the filling plug using a screwdriver or a similar tool.

4. Inject motor liquid into the motor with a filling syringe or similar tool,see fig. 3.

5. To allow possible air to escape, move the motor from side to side. And turn the shaft.

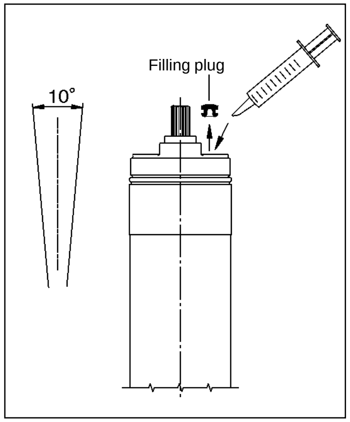


Fig. 3

6. Replace the filling plug and make sure it is tight.

7. Assemble pump end and motor.

8. Install the cable guard.

The pump is now ready for installation.

7. Installation Postions

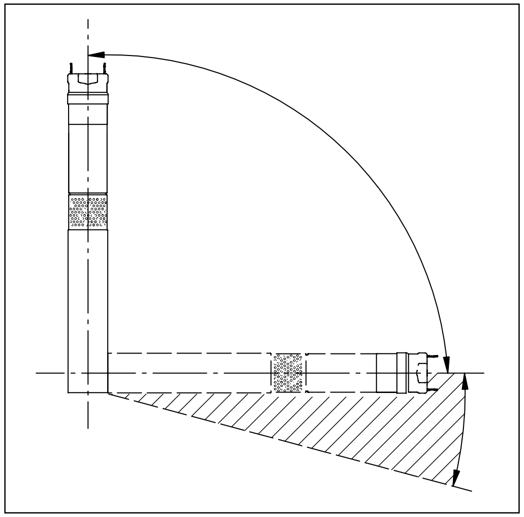


Fig. 4

Positional requirements
The pump is suitable for vertical as well as horizontal installation, however, the pump shaft must never fall below the horizontal plane, see fig. 4.

Installation Procedures

8. Electrical connection

General
The electrical connection should be carried out by an authorized electrician in accordance with local regulations.

Before starting work on the pump, make sure the electricity supply has been switched off and that it cannot be accidentally switched on. The pump must be grounded. The pump must be connected to an external mains switch.

The supply voltage, rated maximum current and power factor (PF) appear on the motor nameplate. The required voltage for GRUNDFOS submersible MSE3-NE motors, measured at the motor terminals, is +6%/–10% of the nominal voltage during continuous operation (including variation in the supply voltage and losses in cables).

If the pump is connected to an installation where a Ground Fault circuit breaker (GFI) is used as additional protection, this circuit breaker must trip out when ground fault currents with DC content (pulsating DC) occur.

Supply voltage:1 x 100-115V or 1 x 200-240 V +6%/–10%, 50/60 Hz.

The current consumption can only accurately be measured by means of a true RMS instrument. If other instruments are used, the value measured will differ from the actual value.
The Redi-Flo3 pumps can be connected to a Redi-Flo3 status box.

**Note: The pump must never be connected to a capacitor or to another type of control box other than a Redi-Flo3 status box.
The pump must never be connected to an external frequency converter.**

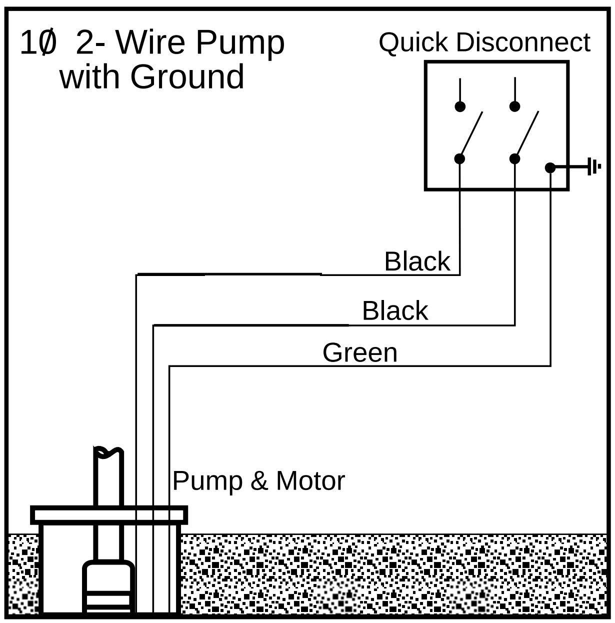
Motor protection
The motor has built-in automatic thermal overload protection and requires no additional motor protection.

Connection of motor
The motor can be connected directly to the main circuit breaker.

9. Making the Wiring Connections

WARNING!
To reduce the risk of electric shock during operation of this pump requires the provision of acceptable grounding. If the means of connection to the supply connected box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor, at least the size of the circuit supplying the pump.

Single-Phase 2-wire Wiring Diagram for GRUNDFOS Motors



A capacitor or control box should NEVER be connected to a Redi-Flo3 submersible pump.

Fig. 5

10. Cable Sizing

SINGLE-PHASE 60 HZ Maximum Cable Length Motor Service to Entrance

Motor Rating		Copper Wire Size								
VOLTS	HP	14	12	10	8	6	4	2	0	00
115	1/3	130	210	340	540	840	1300	1960	2910	
	1/2	100	160	250	390	620	960	1460	2160	
230	1/3	550	880	1390	2190	3400	5250	7960		
	1/2	400	650	1020	1610	2510	3880	5880		
	3/4	300	480	760	1200	1870	2890	4370	6470	
	1	250	400	630	990	1540	2380	3610	5360	6520
	1 1/2	190	310	480	770	1200	1870	2850	4280	5240

11. Motor Cable

Redi-Flo3 pumps are specifically designed to be used with Grundfos SQE-NE Tefzel motor leads. Standard SQE-NE Tefzel motor leads are available between 25 and 300 foot lengths in 5 foot increments. Custom lengths longer than 300 feet are available in 10 foot increments up to 600 feet from the factory.

General
Note: Do not lower or lift the pump by means of the motor cable.

The loose data plate supplied with the pump should be placed close to the installation site.

12. Installing the cable plug to the motor

To install the cable plug, proceed as follows:

1. Check that the cable is of the correct type, cross-section and length.
2. Check that the mains on the location has correct connection to ground.
3. Check that the motor socket is clean and dry.
4. Press the cable plug into the motor socket. The plug will only fit one way, see fig. 6.
5. Install and tighten the four nuts, see fig. 6. When the plug has been installed, there must not be a clearance between the motor and the cable plug.

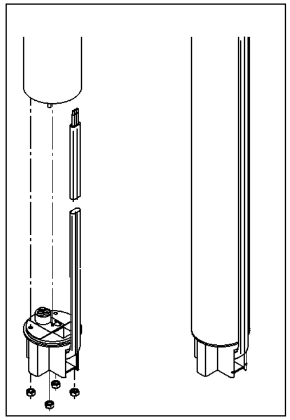


Fig. 6

13. Installing the cable guard

To fit the cable guard, proceed as follows:

1. Make sure that the motor lead lies flat in the cable guard.
2. The two flaps of the cable guard must engage with the upper edge of the pump sleeve, see fig. 7.

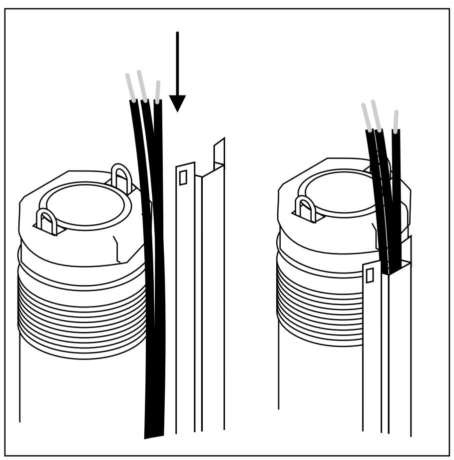


Fig. 7

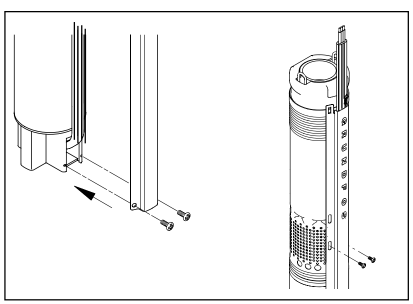


Fig. 8

3. Fasten the cable guard to the cable plug with the four screws supplied, see fig. 8.

14. Piping

- The pump should only be gripped by the two flats at the top of the pump, as shown in fig. 9.
- The pump can be installed vertically or horizontally. During operation, the pump must always be completely submerged in water.
- When plastic pipe is used, a stainless steel safety wire is recommended for lowering and lifting the pump. Fasten the wire to the eyelet on the pump, as shown in fig. 10.
- The threaded joints must be well cut and fit together tightly to ensure that they do not work loose.

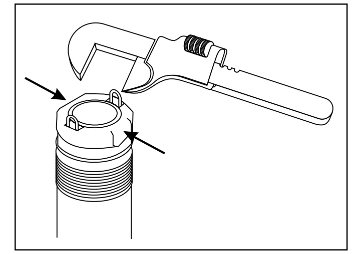


Fig. 9

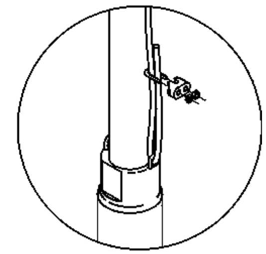


Fig. 10

15. Installing the Pump

Installation Depth
The dynamic water level should always be above the pump see fig. 11.

A = Dynamic water level
B = Static Water Level
C = Minimum 3" well diameter
D = Drawdown
E = Installation depth below static water level. Maximum 500 feet

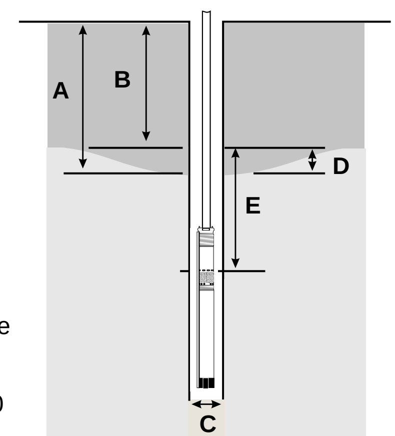


Fig. 11

Procedures
To install the pump, follow these steps:

1. Install the enclosed data plate sticker at the well head.
2. Check the well for proper clearance — the well must be at least 3" in diameter. It is a good idea to check the well for clearance using a plumb ring (2.95 ø x 10 in.).
3. Attach the first section of riser pipe to the pump.

16. Installing the Pump(cont.)

4. Lower the pump into the well. Make sure the motor cable is not damaged when the pump is lifted or lowered into the well — especially in 3" wells. ***NOTE***: **Do not lower or lift the pump using the motor cable.**
5. When the pump has been installed to the required depth, the installation should be finished by means of a well seal. Note that the dynamic water level should always be above the pump.
6. Loosen the safety wire so that it becomes unloaded and lock it to the well seal using a cable clamp.
7. Attach the supplemental information label at the electrical installation site.
8. Complete the electrical connections. **Remember that a capacitor or a control box should NEVER be connected to a Redi-Flo3 submersible pump.**

Installation depths

Maximum installation depth: below the static water level: 500 feet,
Minimum installation depths: 1.75' below the dynamic water level:

Vertical installation:

During start-up and operation, the pump must always be completely submerged in water.

Horizontal installation:

The pump must be installed at least 1.75 ft. below the dynamic water level. If there is a risk that the pump might be covered by mud, the pump must always be placed in a flow sleeve.

17. Generator Operation

- It is OK to operate the Redi-Flo3 with a generator.

The generator must be sized 10% above the pumps P1 (Input Power) values.
Use the table to select the correct size generator for the motor HP.

Motor HP	Min. Generator Size (Watts)
1/3 - 1/2 A	1000
1/2 - 3/4 B	1700
1- $1^1/_2$ C	2000

18. Starting the Pump for the First Time

When the pump has been connected correctly, the pump should be started with the discharge valve closed approximately one-third. Due to the soft start feature, the pump takes approximately 2 seconds to develop full pressure.

Motor Cooling and Other Considerations

- Make sure the well is capable of yielding a minimum quantity of water corresponding to the pump capacity.
- Do not start the pump until it is completely submerged in the liquid.
- As the valve is being opened, the drawdown should be checked to ensure that the pump always remains submerged.
- To ensure the necessary cooling of the motor, the pump should never be set so low that it gives no water. If the flow rate suddenly falls, the reason might be that the pump is pumping more water than the well can yield.

Water Impurities

- If there are impurities in the water, the valve should be opened gradually as the water becomes clearer. The pump should not be stopped until the water is clean, otherwise the pump parts and the check valve may become clogged.
- When the water is clean the valve should be fully opened.

Minimum flow rate

- To ensure the necessary cooling of the motor, the pump flow rate should never be set to a value lower than .2 gpm. If the flow rate suddenly falls, the reason might be that the pump is pumping more water than the well can yield.

Note: The pump's dry-running protection is effective only within the recommended duty range of the pump.

Note: Do not let the pump run against a closed discharge valve for more than 5 minutes. When the discharge valve is closed, there is no cooling flow and there is a risk of overheating in motor and pump.

Built-in protection
The motor incorporates an electronic unit which protects the motor in various damaging situations.

In case of overload, the built-in overload protection will stop the pump for 5 minutes. After 5 minutes, the pump will attempt to restart.
If the pump is started and the well has not recovered, the pump will stop after 30 seconds.

If the pump has been stopped as a result of dry running, it will start automatically after 5 minutes or the reset time set by the R100.

Resetting the pump:
Switch off the electricity supply for 1 minute.
The motor is protected against the following conditions:

- dry running,
- voltage surges (up to 5000 V),
- overvoltage,
- undervoltage,
- overload
- overtemperature.

MSE 3NE Motors:
Note: To set Dry-Run limit in the MSE-NE pumps, you need to connect the pump to a Redi-Flo3 status box. Refer to Redi-Flo3 status box I&O for proper connections.

To set Dry-Run protection, follow these steps:

1. Start the pump against closed discharge.
2. Rapidly read the power consumption value (W) in the R100 display 2.5.
3. Multiply this value by 0.9.
4. Within the R100, go to display 4.6 and enter the new value (minimum power limit).
5. Go to display 4.7 and change the setting to “Active”.

For further information on dry-running, refer to RediFlo3 Status Box I&O.

Maintenance and service:
The pumps are normally maintenance-free. Deposits and wear may occur. For that purpose, service kits and service tools are available from GRUNDFOS. The GRUNDFOS Service Manual is available on request. The pumps can be serviced at a GRUNDFOS service center.

19. Assembly of Pump and Motor

To assemble pump end and motor, proceed as follows:

1. Place the motor horizontally in a vice and tighten it, see fig. 12.
2. Grease the motor shaft end with a vegetable based grease.
3. Screw the pump end on the motor. A spanner may be used on the clamping faces of the pump part, see fig.12.
4. Install cable guard as described on page 7.

When pump end and motor have been assembled correctly, there must not be a clearance between pump end and motor.

To disassemble reverse procedure.

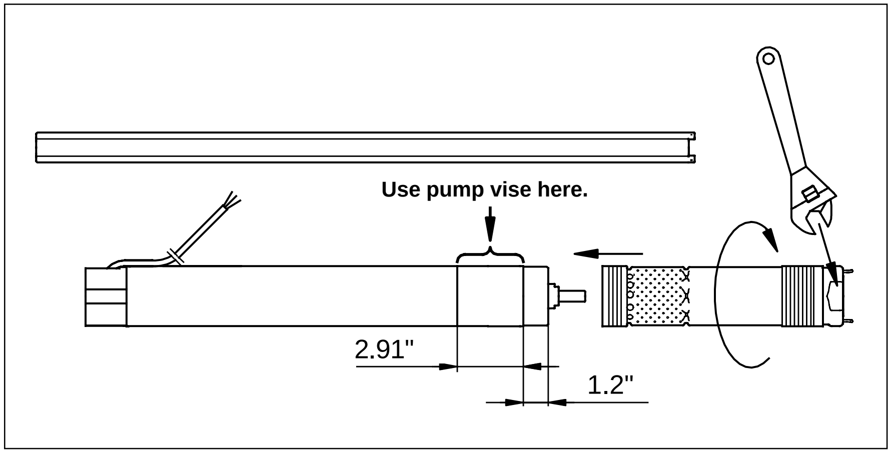


Fig. 12

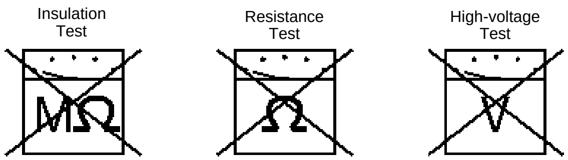
Troubleshooting

Fault	Cause	Remedy
1. The pump does not run	a. The fuses are blown	Replace the blown fuses. If the new fuses blow too, check the electrical installation and the drop cable.
	b. The GFI circuit breaker has tripped.	Reset the circuit breaker.
	c. No electricity supply.	Contact the Electricity provider.
	d. The motor protection has cut off the electricity supply due to overload.	Check for motor/pump blockage.
	e. The drop cable is defective.	Repair/replace the pump/cable.
	f. Overvoltage has occurred.	Check the electricity supply
2. The pump runs but gives no water.	a. The discharge is closed.	Open the valve
	b. No water or too low water level in well.	See item 3a.
	c. Check valve is stuck in it's closed position.	Pull the pump and clean or replace the valve.
	d. The suction strainer is closed.	Pull the pump and clean the strainer.
	e. The pump is defective.	Repair/replace the pump.
3. The pump runs at reduced capacity.	a. The drawdown is larger than anticipated.	Increase the installation depth of the pump, throttle the pump or replace it with a smaller capacity model.
	b. The valve s in the discharge pipe are partly closed/blocked.	Check and clean/replace the valves as necessary.
	c. The discharge pipe is partly chocked by impurities (Iron bacteria).	Clean/replace the discharge pipe.
	d. The non- return valve of the pump is blocked.	Pull the pump and check/replace the valve.
	e. The pump and the riser pipe are partly choked by impurities (Iron bacteria).	Pull out the pump. Check and clean or replace the pump, if necessary. Clean the pipes.
	f. The pump is defective.	Repair/replace the pump.
	g. Hole in discharge pipe.	Check and repair the piping.
	h. The riser pipe is defective.	Replace.
	i. Undervoltage has occurred.	Check the electricity supply.
4. Frequent starts and stops.	a. The differential of the pressure switch between the start and stop pressures is too small.	Increase the differential. However, the stop pressure must not exceed the operating pressure of the pressure tank, and the start pressure should be high enough to ensure sufficient water supply.
	b. The water level electrodes or level switches in the reservior have not been installed correctly	Adjust the intervals of the electrodes/level switches to ensure suitable time between the cutting-in and cutting-out of the pump. See installation and operating instructions for the automatic devices used. If the intervals between start/stop cannot be changed via the automatics, the pump capacity may be reduced by throttling the discharge valve.
	c. Checkvalve is leaking or stuck half-open.	Pull the pump and clean/replace the non-return valve.
	d. The supply voltage is unstable.	Check the electrical supply.
	e. The motor temperature is too high.	Check the water temperature.

Troubleshooting

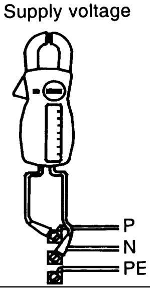
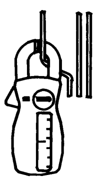
Instruments not allowed:

Note: The use of the following instruments is not allowed during fault finding:



Note: When measuring, use RMS-instruments.

Checking the motor and cable:

1. Supply voltage 	Measure the voltage L1 (RMS) between phase and L2. Connect the voltmeter to the terminals at the connections.	The voltage should, when the motor is loaded, be within the range specified on Page 4, large variations in supply voltage indicate poor electricity supply, and the pump should be stopped until the problem has been corrected.
2. Current consumption 	Measure the current (RMS) while the pump is operating at a constant discharge head(if possible, at capacity where the motor is heavily loaded). For maximum current, see motor nameplate.	If the current exceeds the full load current, there are the following possible faults: Poor connection in the leads, possibly in the cable joint. Too low supply voltage, see item 1 on Page 13.

Environment

During handling, operation, storage and transport, all environment regulations dealing with the handling of hazardous materials must be observed.

When the pump is taken out of operation, it must be ensured that no hazardous material is left in the pump and in the riser pipe, which can be injurous to persons and the environment.

Disposal

Disposal of this product or parts of it must be carried out according to the following guidelines:

1. Use the local public or private waste collection service.
2. If such waste collection service does not exist or cannot handle the materials used in the product, please deliver the product or any hazardous materials from it to your nearest GRUNDFOS company or service center.

Technical Data

Supply Voltage:	1x200-240V +6%/-10%, 50/60 Hz, PE
Operation via Generator:	As a minimum, the generator output must be equal to the motor P1[KW] +10%
Starting Current:	The motor starting current is equal to the highest value stated on the motor nameplate
Starting:	Soft starting
Run-up Time:	Maximum : 2 seconds
Motor Protection:	The motor is protected against: Dry running, overvoltage, undervoltage, overload, overtemperature
Power Factor:	PF= 1
Service Factor:	0.33-0.50A[HP]-1.75 at 230V 0.50-0.75A[HP]-1.4 at 230V 1.0 -1.5C[HP] -1.15 at 230V
Motor Cable: Length	3 Wire, 12 AWG TEFZEL Available in 5 ft. increments from 25ft.- 300ft.
Motor Liquid: **pH Values:**	Type SML 2 Redi-Flo3: 5 to 9
Liquid Temperature:	The temperature of the pumped liquid must not exceed 104°F.
Note: if liquids with a viscosity higher than that of water are to be pumped, please contact GRUNDFOS	
Discharge Port:	5SQE-NE- 1"NPT 10-15SQE-NE- 1 1/4" NPT 22-30SQE-NE- 1 1/2" NPT
STORAGE CONDITIONS	
Minimum Ambient Temperature: **Maximum Ambient Temperature:**	-4°F +140°F
Freeze Protection:	If the pump has to be stored after use, it must be stored on a frost-free location or it must be ensured that the motor liquid is frost-proof. (**The motor must be stored without being filled with motor liquid**.)
OPERATING CONDITIONS	
Minimum Ambient Fluid Temperature: **Maximum Ambient Fluid Temperature:**	34°F +104°F
APPROXIMATE DIMENSIONS AND WEIGHT	
Motor Dimensions (MSE3-NE): 0.33-0.50A[hp] 0.50-0.75B[hp] 1.0-1.5C[hp]	 20.9" length x 2.68" diameter 20.9" length x 2.68" diameter 22.3" length x 2.68" diameter
Motor Weights (MSE3-NE): 0.33-0.50A[hp] 0.50-0.75B[hp] 1.0-1.5C[hp]	 6.0 Lbs 7.1 Lbs 8.2 Lbs
Pump End Dimensions: **Pump Diameter:** **Pump Diameter, incl. cable guard:** **Pump End Dimensions(min. and max.):** 5SQE-NE 10SQE-NE 15SQE-NE 22SQE-NE 30SQE-NE	 2.68" 2.91" 8.1" to 13.6" 8.1" to 14.5" 8.1" to 14.5" 8.1" to 14.5" 8.1" to 11.3"
Pump End Weights(min. and max.): All Redi-Flo3 Models **Well Diameter (minimum):** **Installation Depth (Maximum):**	 2.2 lbs to 3.5 lbs 3" 500 feet, below static water level.

PUMP TYPE	HP	VOLTAGE	MAX. AMPS
5SQE03A-90-NE	1/3 A	230V/115V	3.9/7.8
5SQE03A-120-NE	1/3 A	230V/115V	3.9/7.8
5SQE05A-170-NE	1/2 A	230V/115V	4.9/9.8
5SQE05B-210-NE	1/2 B	230V	4.9
5SQE05B-250-NE	1/2 B	230V	4.9
5SQE07B-290-NE	3/4 B	230V	7.6
5SQE10C-340-NE	1 C	230V	7.6
5SQE10C-380-NE	1 C	230V	7.6
5SQE10C-420-NE	1 C	230V	7.6
10SQE03A-100-NE	1/3 A	230V/115V	3.9/7.8
10SQE05A-140-NE	1/2 A	230V/115V	4.9/9.8
10SQE05B-180-NE	1/2 B	230V	4.9
10SQE07B-220-NE	3/4 B	230V	7.6
10SQE10C-260-NE	1 C	230V	7.6
10SQE10C-300-NE	1 C	230V	7.6
10SQE15C-340-NE	1 1/2 C	230V	11.1
15SQE03A-70-NE	1/3 A	230V/115V	3.9/7.8
15SQE05A-110-NE	1/2 A	230V/115V	4.9/9.8
15SQE05B-130-NE	1/2 B	230V	4.9
15SQE07B-170-NE	3/4 B	230V	7.6
15SQE10C-200-NE	1 C	230V	7.6
15SQE10C-230-NE	1 C	230V	7.6
15SQE15C-270-NE	1 1/2 C	230V	11.1
22SQE03A-40-NE	1/3 A	230V/115V	3.9/7.8
22SQE05A-80-NE	1/2 A	230V/115V	4.9/9.8
22SQE05B-110-NE	1/2 B	230V	4.9
22SQE07B-140-NE	3/4 B	230V	7.6
22SQE10C-180-NE	1 C	230V	7.6
22SQE15C-210-NE	1 1/2 C	230V	11.1
30SQE05A-40-NE	1/2 A	230V/115V	4.9/9.8
30SQE05B-80-NE	1/2 B	230V	7.6
30SQE10C-120-NE	1 C	230V	7.6
30SQE15C-160-NE	1 1/2 C	230V	11.1

ACCESSORIES	
PRODUCT	**PART NUMBER**
CU 300	96422776
Flow Sleeve	96037505
Grease	96037562
Grundfos SPP1 Potentiometer	625468
RediFlo3 Motor Leads - available in 5ft. increments	See price list
25ft	96037428
50ft	96037429
75ft	96037430
100ft	96037431
125ft	96037432
150ft	96037433
175ft	96037434
200ft	96037435
225ft	96037436
250ft	96037437
300ft	96037438
R100 Infrared Remote	625333
HP Infrared Printer 822408	620480

LDAP4B

AutoPump®

Low-Drawdown, Bottom Inlet

Max. Flow	**7.0 gpm (26.5 lpm)**
O.D.	**3.5 in (8.9 cm)**
Length	**25 in. (63.5 cm)**

Description

The AP4 Low-Drawdown Bottom Inlet AutoPump provides maximum capabilities and flow in a bottom inlet pump for 4" (100 mm) diameter and larger wells with very short water columns and/or the need to pump down to as low as 11.5 inches (29 cm) above the bottom. It is offered in optional versions to handle even the most severe remediation and landfill pumping applications, and delivers flow rates up to 7 gpm (26.5 lpm). The AP4 Low Drawdown Bottom Inlet AutoPump is complemented by the most comprehensive selection of accessories to provide a complete system to meet site specific requirements. Call QED for prompt, no-obligation assistance on your pumping project needs.

The AutoPump Heritage

The AP4 Low-Drawdown Bottom Inlet AutoPump is part of the famous AutoPump family of original automatic air-powered pumps, developed in the mid 1980s specifically to handle unique pumping needs at remediation and landfill sites. Over the years they've proven their durability at thousands of sites worldwide. AutoPumps are designed to handle difficult pumping challenges that other pumps can't, such as hydrocarbons, solvents, suspended solids, corrosives, temperature extremes, viscous fluids and frequent start/stop cycles. Beyond just the pump, AutoPump systems offer the most complete range of tubing, hose, connectors, wellhead caps and accessories to help your installation go smoothly. This superior pumping heritage, application experience and support back up every AutoPump you put to work on your project.

Advantages

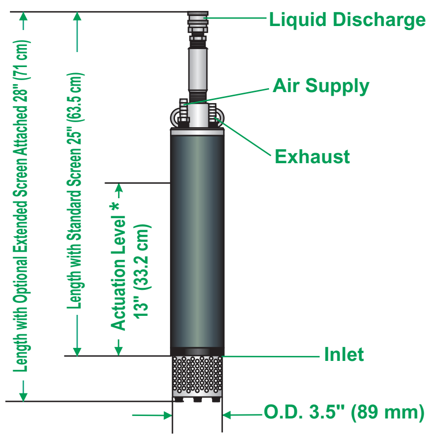
1. **The original automatic air-powered well pump, proven worldwide over 18 years**
2. **The highest flow rates and deepest pumping capabilities in the industry in a low drawdown top-fill pump**
3. **Patented, proven design for superior reliability and durability, even in severe applications**
4. **Handles solids, solvents, hydrocarbons corrosive conditions, viscous fluids and high temperatures beyond the limits of electric pumps**
5. **One-year warranty**

AutoPump®

Low-Drawdown, Bottom Inlet

LDAP4B

Pump Dimensions



* Optional radial inlet model provides 11.5" (29 cm) actuation level

Specifications & Operating Requirements

Model	**4" - Low-Drawdown AP4 Bottom Inlet**
Liquid Inlet Location	Bottom (standard plug type check valve)
OD	3.5 in. (8.9 cm)
Length Overall (pump & fittings)	25 in. (63.5 cm)
Length Overall, w / Extended Screen	28 in. (71.1 cm)
Weight	11 lbs. (5.0 kg)
Max. Flow Rate	7 gpm (26.5 lpm)
Pump Volume / Cycle	0.11 - 0.16 gal (.42 - .61L)
Max. Depth	250 ft. (76 m)
Air Pressure Range	5 - 120 psi (0.4 - 8.4 kg/cm2)
Min. Actuation Level	13 in. (33.2 cm) standard outlet 11.5 in. (29 cm) w/ radial inlet
Air Usage	.32 - 2.86 scf/gal (2.2 - 21.5 litres of air/fluid litres) See air usage chart
Min. Liquid Density	0.7 SpG (0.7 g/cm3)
Standard Construction Materials[1]	
Pump Body	Fiberglass or Stainless Steel
Pump Ends	Stainless Steel, UHMWPE[3], Brass
Internal Components	Stainless Steel, Viton, Acetal, PVDF[4]
Tube & Hose Fittings	Brass or Stainless Steel
Fitting Type	Barbs or Quick Connects
Tube & Hose Options	
Tubing Material[2]	Nylon
Sizes - Liquid Discharge	1 in. (25 mm) or 1-1/4 in. (32 mm) OD
Pump Air Supply	1/2 in. (13 mm) OD
Air Exhaust	5/8 in. (16 mm) OD
Hose Material	Nitrile
Sizes - Liquid Discharge	3/4 in. (19 mm) or 1 in. (25 mm) ID
Pump Air Supply	3/8 in. (9.5 mm) ID
Air Exhaust	1/2 in. (13 mm) ID

[1]Material upgrades available
[2] Applies to QED supplied tubing; other tubing sources may not conform to QED fittings.
[3] UHMWPE - Ultra High Molecular Weight Polyethylene
[4] PVDF - Polyvinylidene Fluoride

Application Limits (Base model)

AP4 AutoPumps are designed to handle the application ranges described below. For applications outside these ranges, consult QED about AP4 upgrades.

Maximum Temperature: 150°F (65°C)
pH Range: 4-9
Solvents and Fuels: diesel, gasoline, JP1-JP6, #2 heating oils, BTEX, MTBE, landfill liquids

Low-Drawdown AP-4 AutoPumps warranted for one (1) year: 100% materials and workmanship.

P.O. Box 3726 Ann Arbor, MI 48106-3726 USA **1.800.624.2026** **F 1.734.995.1170** info@qedenv.com www.qedenv.com

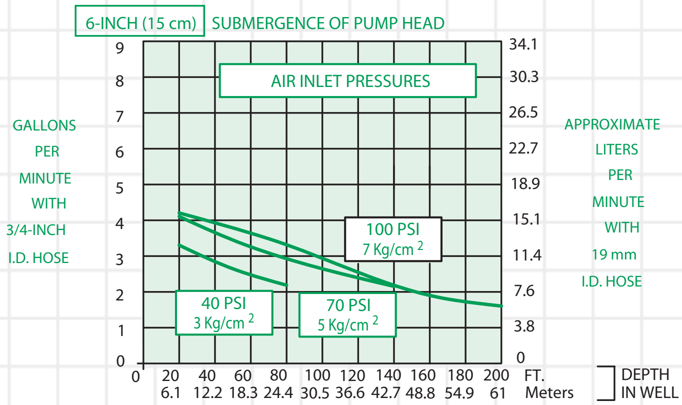
LDAP4B

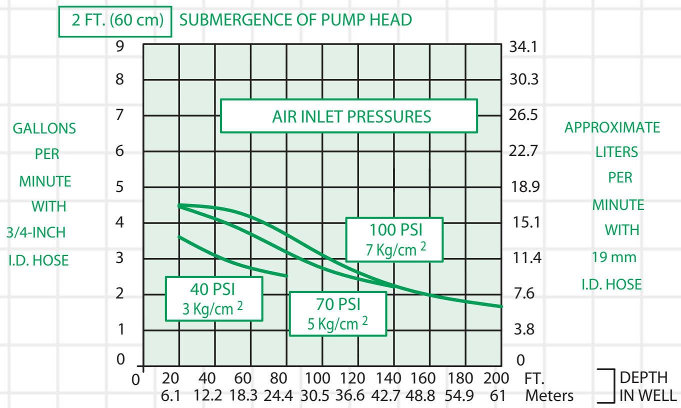
AutoPump®

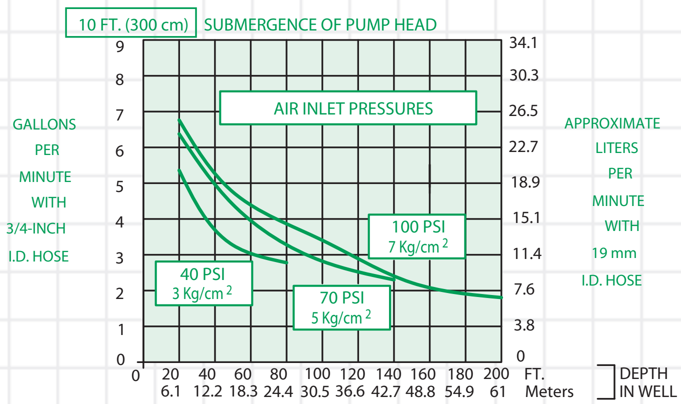
Low-Drawdown, Bottom Inlet

Flow Rates[1]

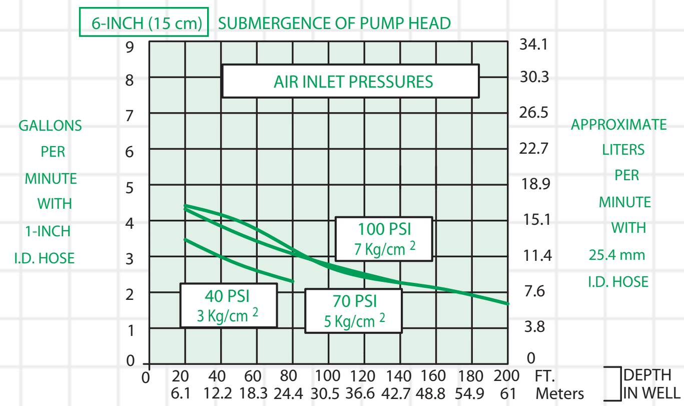
3/4 inch (19 mm) Inside Diameter Discharge Hose
(Equivalent to 1-Inch O.D. Tubing)

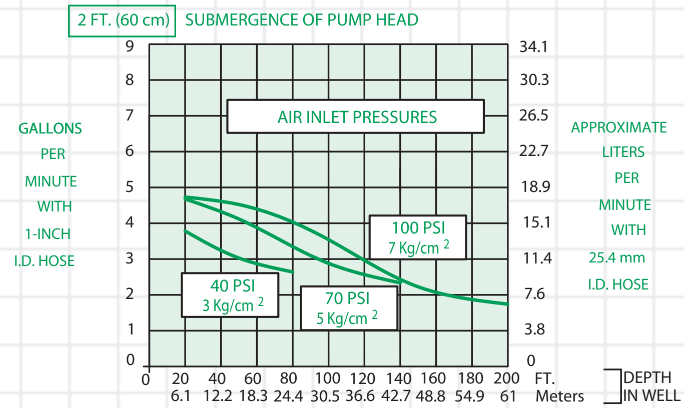


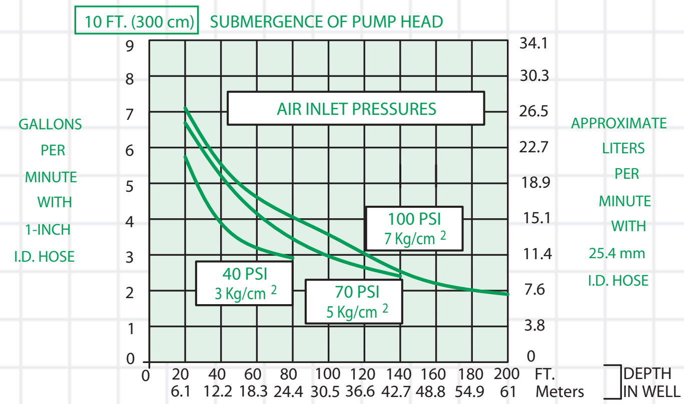




1 inch (25.4 mm) Inside Diameter Discharge Hose
(Equivalent to 1.25-Inch O.D. Tubing)



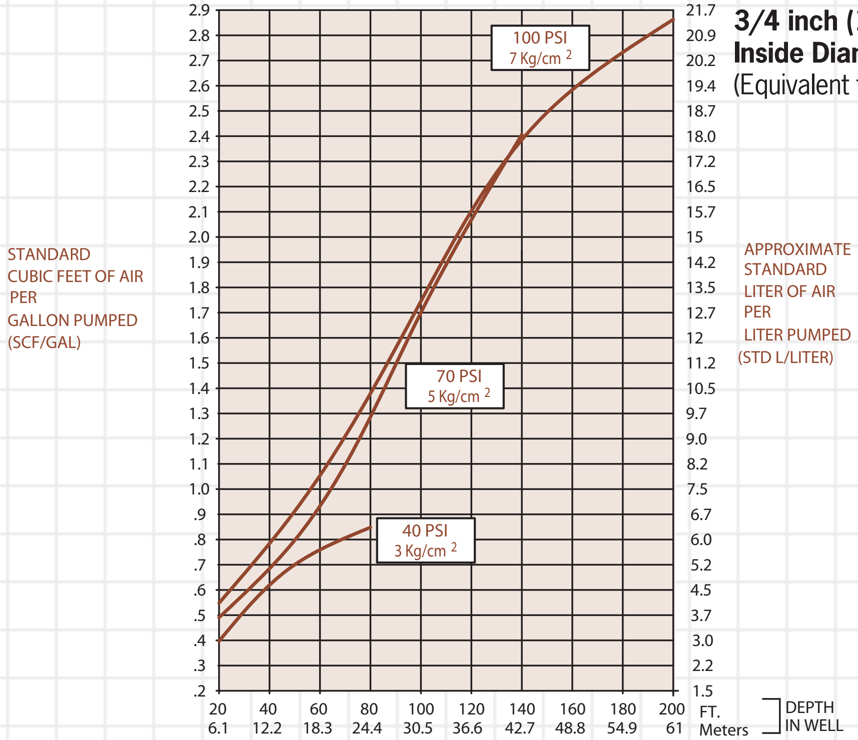




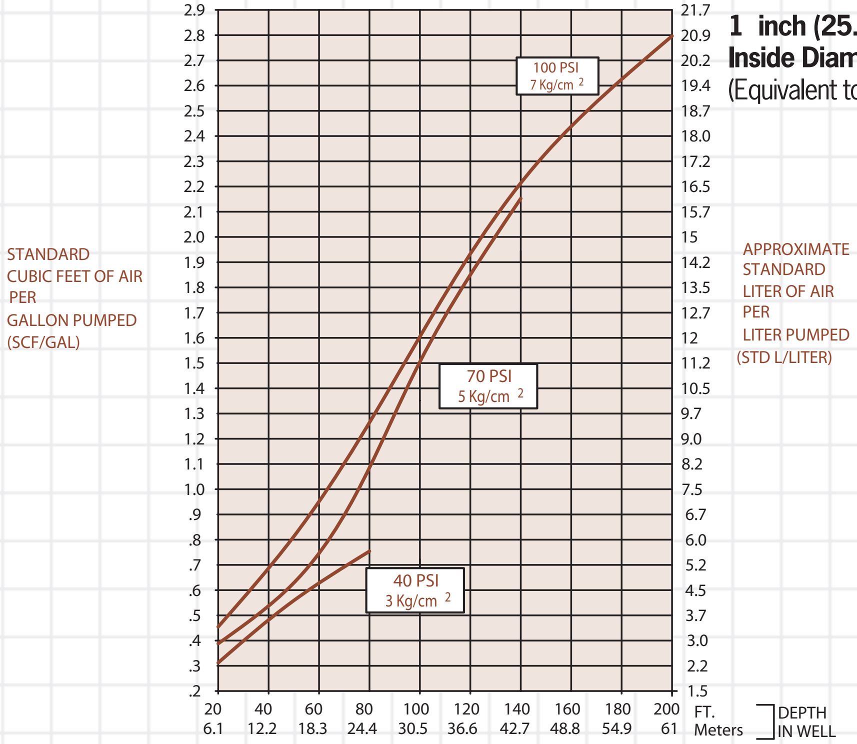
[1]FLOW RATES MAY VARY WITH SITE CONDITIONS. CALL QED FOR TECHNICAL ASSISTANCE.

LDAP4B

Air Consumption



3/4 inch (19 mm)
Inside Diameter Discharge Hose
(Equivalent to 1-Inch O.D. Tubing)



1 inch (25.4 mm)
Inside Diameter Discharge Hose
(Equivalent to 1.25-Inch O.D. Tubing)

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